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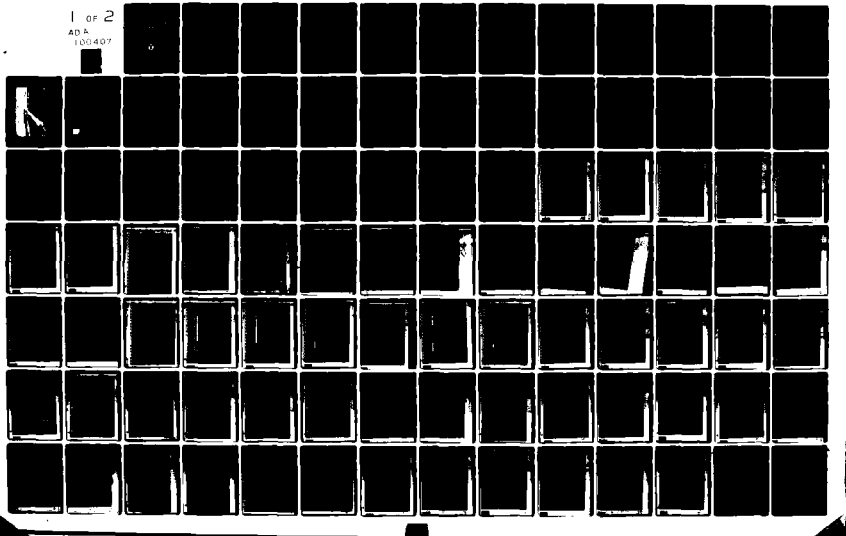

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DELAWARE RIVER BASIN
BRANCH OF BIG FLAT BROOK
SUSSEX COUNTY
NEW JERSEY.

LEVEL II

LAKE ROBERT ROOKE DAM
NJ 00262

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	National Dam Safety Program	Outlet Works
Embankments	Lake Robert Rooke Dam, N.J.	Seepage
Visual Inspection	Spillways	
Structural Analysis	Weirs	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-N

17 JUN 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED.

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Lake Robert Rooke Dam in Sussex County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Lake Robert Rooke Dam, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillways are considered inadequate because a flow equivalent to 52 percent of the Probable Maximum Flood would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillways' adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. The following remedial actions should be initiated within three months from the date of approval of this report:

(1) Determine the operating condition of the low level outlet slide gate and repair if necessary.

(2) Remove the cobble dam and other obstructions from the drop inlet discharge channel.

(3) Remove all branches and debris from the weirs and riser of the drop inlet spillway and provide trash racks.

(4) Repair all eroded areas on the dam embankment.

c. The following remedial actions should be initiated within six months from the date of approval of this report:

(1) Perform additional investigation to determine seepage conditions through and under the dam, the engineering properties of the dam and foundation, and determine whether or not conventional safety margins exist under more severe stress conditions than those observed during the inspection, and what modifications may be required to achieve such safety margins.

(2) Properly remove all trees from the embankment and provide adequate filter coverage on the downstream face to prevent any piping which may occur as a result of future root decay.

d. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

e. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within three months from the date of approval of this report.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

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NAPEN-N
Honorable Brendan T. Byrne

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
Commander and District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

LAKE ROBERT ROOKE DAM (NJ00267)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 26 September and 11 December 1980 by Langan Engineering Associates, Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Lake Robert Rooke Dam, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillways are considered inadequate because a flow equivalent to 52 percent of the Probable Maximum Flood would cause the dam to be overtopped. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillways' adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

b. The following remedial actions should be initiated within three months from the date of approval of this report:

(1) Determine the operating condition of the low level outlet slide gate and repair if necessary.

(2) Remove the cobble dam and other obstructions from the drop inlet discharge channel.

(3) Remove all branches and debris from the weir and riser of the drop inlet spillway and provide trash racks.

(4) Repair all eroded areas on the dam embankment.

c. The following remedial actions should be initiated within six months from the date of approval of this report:

(1) Perform additional investigation to determine seepage conditions through and under the dam, the engineering properties of the dam and foundation, and determine whether or not conventional safety margins exist under more severe stress conditions than those observed during the inspection, and what modifications may be required to achieve such safety margins.

(2) Properly remove all trees from the embankment and provide adequate filter coverage on the downstream face to prevent any piping which may occur as a result of future root decay.

d. The owner should develop written operating procedures and a periodic maintenance plan to ensure the safety of the dam within one year from the date of approval of this report.

e. An emergency action plan and warning system should be developed which outlines actions to be taken by the owner to minimize the downstream effects of an emergency at the dam within three months from the date of approval of this report.

APPROVED: _____

JAMES G. TON
Colonel, Corps of Engineers
Commander and District Engineer

DATE: 4 Jun 1981

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	LAKE ROBERT ROOKE DAM
ID NUMBER:	FED ID No NJ 00262
STATE LOCATED:	NEW JERSEY
COUNTY LOCATED:	SUSSEX
STREAM:	BRANCH OF BIG FLAT BROOK
RIVER BASIN:	DELAWARE
DATE OF INSPECTION:	SEPTEMBER 1980

ASSESSMENT OF GENERAL CONDITIONS

Lake Robert Rooke dam, classified as having high hazard potential, is in fair overall condition. Localized spongy ground exists at the downstram toe. Minor erosion has occurred in a number of places on the dam embankment. No riprap was observed on the upstream embankment or in drop inlet spillway discharge channel. The embankments and emergency spillway are becoming overgrown with brush and trees. Many branches have become lodged in the weirs and riser of the drop inlet spillway. The slide gate of the low level outlet located in the spillway riser is leaking and its operating conditon is unknown. The dam appeared stable during our inspection, however, the available information is inadequate to determine the degree of stability of the dam and its future performance under more severe stress conditions than those observed during our inspection.

The combined drop inlet and emergency spillway capacity as determined by the Corps of Engineers Screening criteria is inadequate. We estimate the dam can adequately pass only 51% of the PMF.

The following are recommended to be done soon:

Determine the operating condition of the low level outlet slide gate and repair if necessary. Remove the cobble dam and other obstructions from the drop inlet discharge channel. Remove all branches and debris from the weirs and riser of the drop inlet spillway and provide trash racks. Repair all eroded areas on the dam embankments.

The following measures are recommended to be taken in the near future:

Develop written operational procedures and periodic maintenance plan to ensure the safety of the dam. Perform additional investigation to determine seepage conditions through and under the dam, the engineering properties of the

dam and foundation, and determine whether or not coventional safety margins exist under more severe stress conditions than those observed during our inspection, and what modifications may be required to achieve such safety margins. Properly remove all trees from the embankment and provide adequate filter coverage on the downstream face to prevent any piping which may occur as a result of future root decay.

K. Peter Yu, P.E.

OVERALL VIEW
LAKE ROBERT ROCK DAM

26 September 1980

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NAME OF DAM:	LAKE ROBERT ROOKE DAM
ID NUMBER:	FED ID No NJ 00262
STATE LOCATED:	NEW JERSEY
COUNTY LOCATED:	SUSSEX
STREAM:	BRANCH OF BIG FLAT BROOK
RIVER BASIN:	DELAWARE
DATE OF INSPECTION:	SEPTEMBER 1980

LANGAN ENGINEERING ASSOCIATES, INC.

Consulting Civil Engineers
990 CLIFTON AVENUE
CLIFTON, NEW JERSEY
201-472-9366

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NATIONAL DAM SAFETY REPORT

LAKE ROBERT ROOKE DAM FED ID NO NJ 00262

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

SECTION 1 PROJECT INFORMATION

1.1 General

Authority to perform the Phase I Safety Inspection of Lake Robert Rooke Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by letter dated 12 August 1980. This Authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the US Army Engineers District, Philadelphia.

The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to safety of Lake Robert Rooke Dam and appurtenances based upon available data and visual inspection, and determine any need for emergency measures and conclude if additional studies, investigations and analyses are necessary and warranted. The assessment is made using screening criteria established in Recommended Guidelines for Safety Inspection of Dams prepared by the Department of Army, Office of the Chief of Engineers. It is not the purpose of the inspection report to imply that a dam meeting or failing to meet the screening criteria is, per se, certainly adequate or inadequate.

1.2 Project Description

a. Description of Dam and Appurtenances

Lake Robert Rooke Dam is a 620 foot long, 20 foot high earthfill dam constructed in 1963 through 1964. The dam has a top width of approximately 14 feet with side slopes of 2H:1V downstream and 2 1/2 H:1V upstream. It has a reinforced concrete drop inlet spillway with a 16 inch diameter CIP valved low level outlet discharging into the spillway riser. The spillway discharges through a 54 inch diameter CMP. There is an earth cut emergency spillway located beyond the right abutment of the dam.

b. Location

The dam is located at the southwest end of Lake Robert Rooke off Flat Brook Road in Sandyston Township, Sussex County, New Jersey. It is located at north latitude 41°12.7' and west longitude 74°47.9'. A regional vicinity map is given in Fig. 1.

c. Size Classification

Lake Robert Rooke Dam is classified as "small" based on its maximum height of 20 feet which is less than 40 feet. It is classified as "small" based on its maximum storage capacity of 147 ac ft which is more than 50 ac ft but less than 1000 ac ft. Accordingly, the dam is classified as "small" in size.

d. Hazard Classification

In the National Inventory of Dams, Lake Robert Rooke Dam has been classified as having "High Hazard Potential" on the basis that failure of the dam would cause excessive damage to residences downstream and could potentially cause more than a few deaths. As the dam is centrally located in a YM-YWCA camp ground area which is highly utilized and a major highway (Rt 206) is less than 1/2 mile downstream, it is recommended to keep the Hazard Classification Potential as "High".

e. Ownership

Ownership of the Dam is by the Young Mens and Young Womens Christian Association of Newark and Vicinity, 600 Broad Street, Newark, New Jersey.

f. Purpose of Dam

The purpose of the dam is recreation.

g. Design and Construction History

The dam was designed jointly by the US Department of Agriculture, Soil Conservation Service, and the firm of Woodward-Clyde-Sherard and Associates in 1963. Construction of the dam was begun in 1963 and completed in June of 1964.

h. Normal Operational Procedures

No information has been found concerning operational procedures for the dam.

1.3 Pertinent Data

a.	Drainage Area	1.05 sq. mi.
b.	Discharge at Damsite	
	Maximum known flood at damsite	unknown
	Ungated spillway capacity at max. pool elevation (Includes drop inlet & emergency spillway)	2093 cfs (Assumes top of dam)
	Total spillway capacity at maximum pool elevation (Includes drop inlet & emergency spillway)	2093 cfs (Assumes top of dam)
c.	Elevation (Arbitrary datum, taken from available drawings)	
	Top Dam	115.9
	Emergency Spillway Crest	112.7

	Spillway Crest	110.0
	Recreation pool	110.0
	Streambed at centerline of dam	Approx 95.5
	Maximum tailwater	unknown
d.	Reservoir	
	Length of maximum pool	Approx 1300 ft
	Length of recreation pool	Approx 950 ft
e.	Storage (acre-feet)	
	Recreation pool	69 ac-ft
	Top of dam	147.0 ac-ft
f.	Reservoir Surface (acres)	
	Top dam	16.2 ac
	Recreation pool	10.8 ac
g.	Dam	
	Type	Earthfill
	Length	620 ft
	Height	20 ft
	Top Width	14 ft
	Side Slopes	U/S 2 1/2H:1V D/S 2H:1V
	Zoning	None indicated on plans
	Impervious Core	Low permeability soil indicated on plans
	Cutoff	No
	Grout curtain	No

h. Principal Spillway

Type	Reinforced concrete drop inlet
Length of weir	NA
Crest elevation	110.0 (Arbitrary datum)
Gates	None
U/S Channel	NA
D/S Channel	54 in dia. CMP

i. Emergency Spillway

Type	Trapezoidal open channel
Crest elevation	112.7
Width	120 ft
Weir crest length	20 ft
Location	Approx 100 ft west of right dam abutment
U/S Channel	Earth, slopes 0.0205 ft/ft up
D/S Channel	Earth, slopes 0.0400 to 0.0312 ft/ft down

j. Regulating Outlets — 16 in dia valved CIP low level outlet discharging into spillway riser

SECTION 2 ENGINEERING DATA

2.1 Design

Lake Robert Rooke Dam was designed jointly by the US Department of Agriculture, Soil Conservation Service and the firm of Woodward-Clyde-Sherard and Associates.

Included in Appendix 1 are:

a. Preliminary Report entitled Soil and Foundation Investigation and Design, Newark YMCA Dam, Sandyston Township, New Jersey dated 18 June 1963 by Woodward-Clyde-Sherard Associates.

b. Design Report N. J. - 625-R entitled Earthfill Dam on Branch of Big Flat Brook, Linwood, Newark YM-YWCA Family and Senior Citizens Camp, Sandyston Township, Sussex Co., New Jersey, dated 16 August 1963 by the US Department of Agriculture, Soil Conservation Service.

c. A set of pertinent design calculations.

2.2 Construction

There is little information available pertaining to the actual construction of the dam. Based on a letter of 11 January 1967 from Mr. Joseph H. Partenheimer, Vice President of the YW-YMCA of Newark and Vicinity to Mr. George R. Shanklin, Chief Engineer and Director, N.J. Division of Water Policy and Supply, there was a licensed engineer in residence during the construction of the dam. Other available information indicates the dam was constructed in accordance with the approved plans and specifications. Included in Appendix 1 are:

a. Report on Dam Inspection, Newark YMCA Dam, Dam Application No. 564, 2 Oct 1963, by Mr. John H. O'Dowd, Supervisory Engineer, NJ Division of Water Policy and Supply,

b. Final Report, Construction Inspection, Newark YMCA Dam, Sandyston Township, New Jersey, 14 July 1964 by Woodward-Clyde-Sherard and Associates, and,

c. Letter, 11 January 1967 from Mr. Joseph H. Partenheimer, Vice President, YM-YWCA of Newark and Vicinity to Mr. George B. Shanklin, Chief Engineer and Director, N.J. Division of Water Policy and Supply.

2.3 Operation

No information is available concerning the operation of Lake Robert Rooke Dam.

2.4 Evaluation

Information concerning the design of the dam is available, however, data pertaining to the engineering properties of the dam and foundation materials is inadequate. The existing available information appears to be valid.

SECTION 3 VISUAL INSPECTION

Lake Robert Rooke Dam appeared to be in fair overall condition at the time of our visual inspection. Minor erosion has occurred in numerous places on the dam embankments. Much of this erosion is due to footpaths along the embankments. The upstream embankment is eroded at the normal pool level. No riprap was observed on the upstream embankment. Localized spongy ground exists at the downstream toe near the centerline of the dam. The embankments are becoming overgrown with brush and small diameter trees.

The drop inlet spillway weirs and riser are accumulating many branches. The slide gate on the 16 inch diameter low level outlet is leaking. The operating condition of the low level outlet is unknown.

The emergency spillway beyond the right abutment of the dam is moderately vegetated with trees and brush.

The reservoir area is surrounded by gently sloping forested land.

The downstream channel beyond the 54 inch CMP drop inlet spillway outlet is a gently sloping streambed surrounded by thick brush and trees. A small cobble dam approximately 1 foot high has been built across the streambed about 30 feet below the sillway discharge pipe. No riprap was observed in the discharge channel.

SECTION 4 OPERATIONAL PROCEUDRES

No information concerning operational procedures for the dam have been found. There appears to have been no recent maintenance of the dam. No warning system appears to be in effect.

SECTION 5 HYDRAULICS/HYDROLOGIC

Based on available information, Lake Robert Rooke Dam was designed in 1963 to adequately pass a Six-hour Point Rainfall determined from the U. S. Weather Bureau Technical Paper No. 40 and a Six-hour Point Rainfall Map developed by the U. S. Soil Conservation Service based on records of maximum rainfalls. This storm is equivalent to 10.2 inches of rainfall and has a peak inflow of 2460 cfs. Some design data and calculations are included in Appendix 1.

Conversations with personnel at the YW-YMCA camp report that the dam has not been overtopped to their knowledge.

The hydraulic/hydrologic evaluation is based on a Spillway Design Flood (SDF) equal to the Probable Maximum Flood chosen in accordance with the evaluation guidelines for dams classified as high hazard and small in size. The PMF has been determined by developing a synthetic hydrograph based on the probable maximum precipitation of 22.0 inches (200 sq. mi. - 24 hour). The Corps of Engineers has recommended the use of the SCS triangular unit hydrograph with the curvilinear transformation. Hydrologic computations are presented in Appendix 4. The PMF peak inflow determined for the subject watershed is 4236 cfs.

The combined capacity of the drop inlet and emergency spillway at maximum pool elevation 115.9 is 2093 cfs which is significanltly less than the SDF. Flood routing for the PMF indicates the dam will overtop by 0.82 ft. Routing for the 1/2 PMF indicates the dam will not overtop. We estimate the dam can adequatley pass only 51% of the PMF.

The present drawdown structure consists of a 16 inch CIP with a slide gate discharging into the spillway riser. Its present operating condition is unknown. Drawdown of the reservoir has been evaluated assuming that the drawdown structure is operable. Our calculations indicate that the lake level could be lowered 3 ft in about 1 day and 12 ft in about 3 days.

SECTION 6 STRUCTURAL STABILITY

Based upon visual observations, the dam appeared stable under conditions existing at the time of our inspection. Slope stability analysis done by the Soil Conservation Service reported a factor of safety of 2.93. However, the analysis was based on estimated values of the engineering properties of foundation and dam materials and represented only one trial failure arc on the upstream face of the dam. Therefore, the stability of the dam may appear to be within conventional safety margins, yet there is insufficient data concerning the engineering properties of dam and foundation materials to determine the degree of stability of the dam.

No operational records have been found. No post construction changes were observed at the time our inspection.

Lake Robert Rooke dam is located in Seismic Zone I of the Seismic Zone Map of Contiguous States. As incomplete analytical evaluation of the static stability of the dam is available, its seismic stability cannot be adequately evaluated without additional investigation.

SECTION 7 ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

Lake Robert Rooke dam is in fair overall condition. Localized spongy ground exists at the downstram toe. Minor erosion has occurred in a number of places on the dam embankment. No riprap was observed on the upstream embankment or in drop inlet spillway discharge channel. The embankments and emergency spillway are becoming overgrown with brush and trees. Many branches have become lodged in the weirs and riser of the drop inlet spillway. The slide gate of the low level outlet located in the spillway riser is leaking and its operating condition is unknown. The dam appeared stable during our inspection, however, the available information is inadequate to determine the degree of stability of the dam and its future performance under more severe stress conditions than those observed during our inspection.

The combined drop inlet and emergency spillway capacity as determined by the Corps of Engineers Screening criteria is inadequate. We estimate the dam can adequately pass only 51% of the PMF.

7.2 Recommendations/Remedial Measures

The following measures are recommended to be taken soon:

1. Determine the operating condition of the low level outlet slide gate and repair if necessary.

2. Remove the cobble dam and other obstructions from the drop inlet discharge channel.

3. Remove all branches and debris from the weirs and riser of the drop inlet spillway and provide trash racks.

4. Repair all eroded areas on the dam embankments.

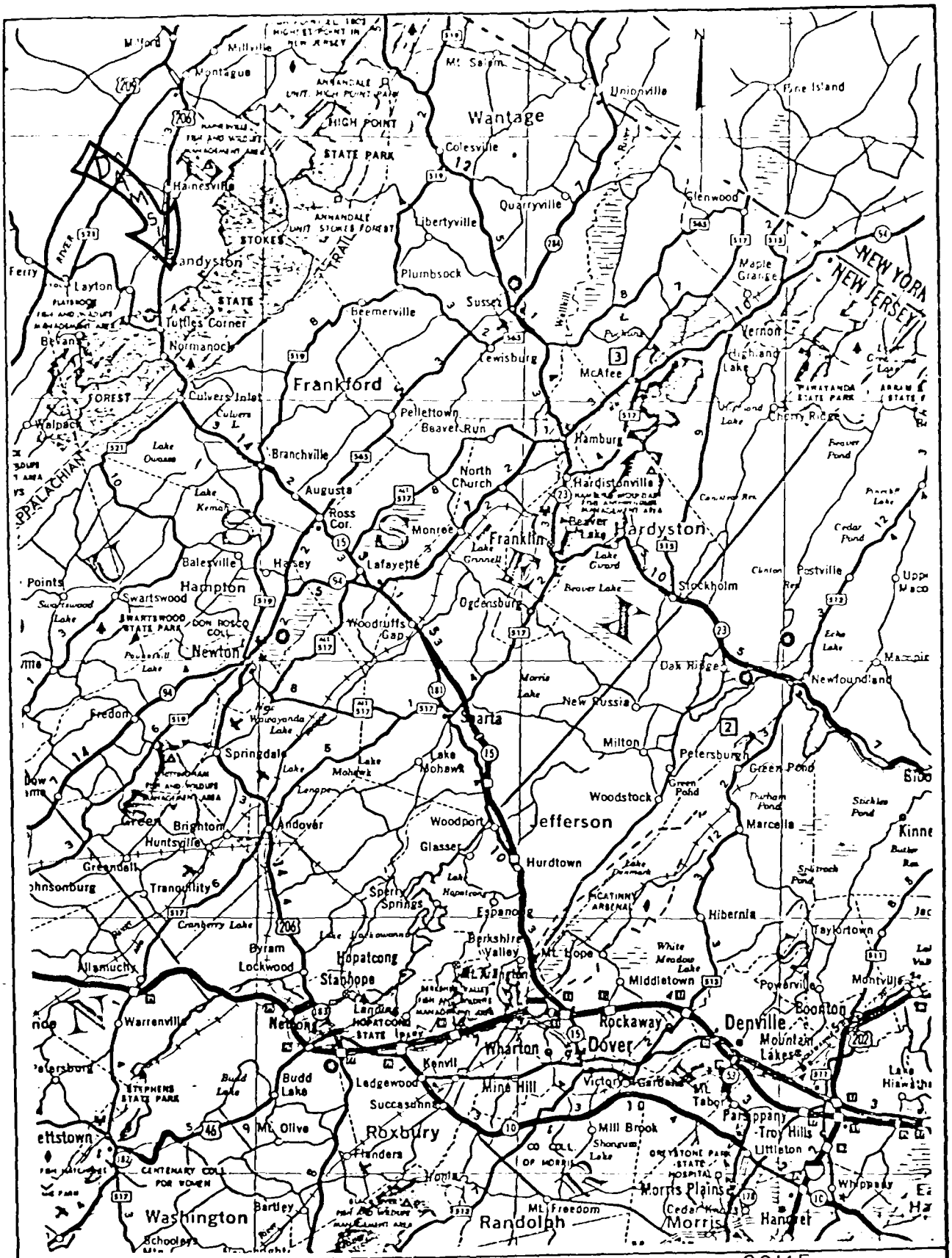
The following measures are recommended to be taken in the near future:

1. Develop written operational procedures and periodic maintenance plan to ensure the safety of the dam.

2. Perform additional investigation to determine seepage conditions through and under the dam, the engineering properties of the dam and foundation, and determine whether or not coventional safety margins exist under more severe stress conditions than those observed during our inspection, and what modifications may be required to achieve such safety margins.

3. Properly remove all trees from the embankment and provide adequate filter coverage on the downstream face to prevent any piping which may occur as a result of future root decay.

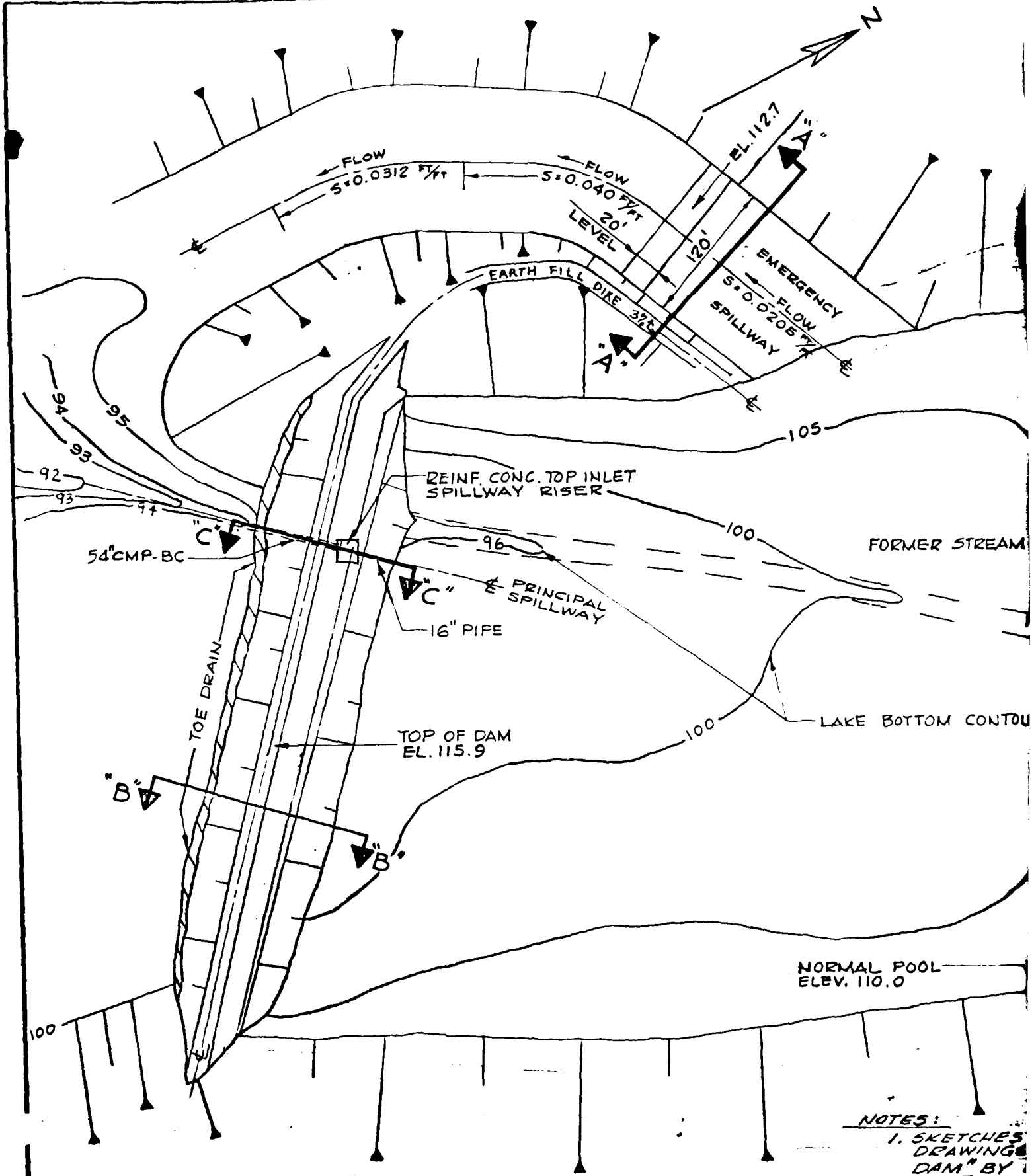
FIGURES



BY _____ DATE _____ REGIONAL VICINITY MAP JOB NO. 80145

CKD _____ DATE _____ LAKE ROBERT ROOKE FIG. 1

SCALE: 1" = 5 MILES



NOTES:

1. SKETCHES
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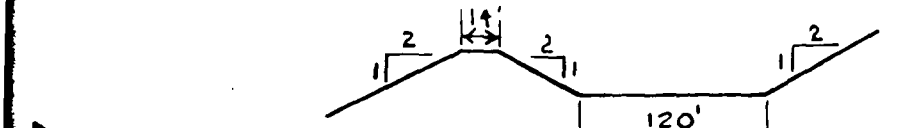
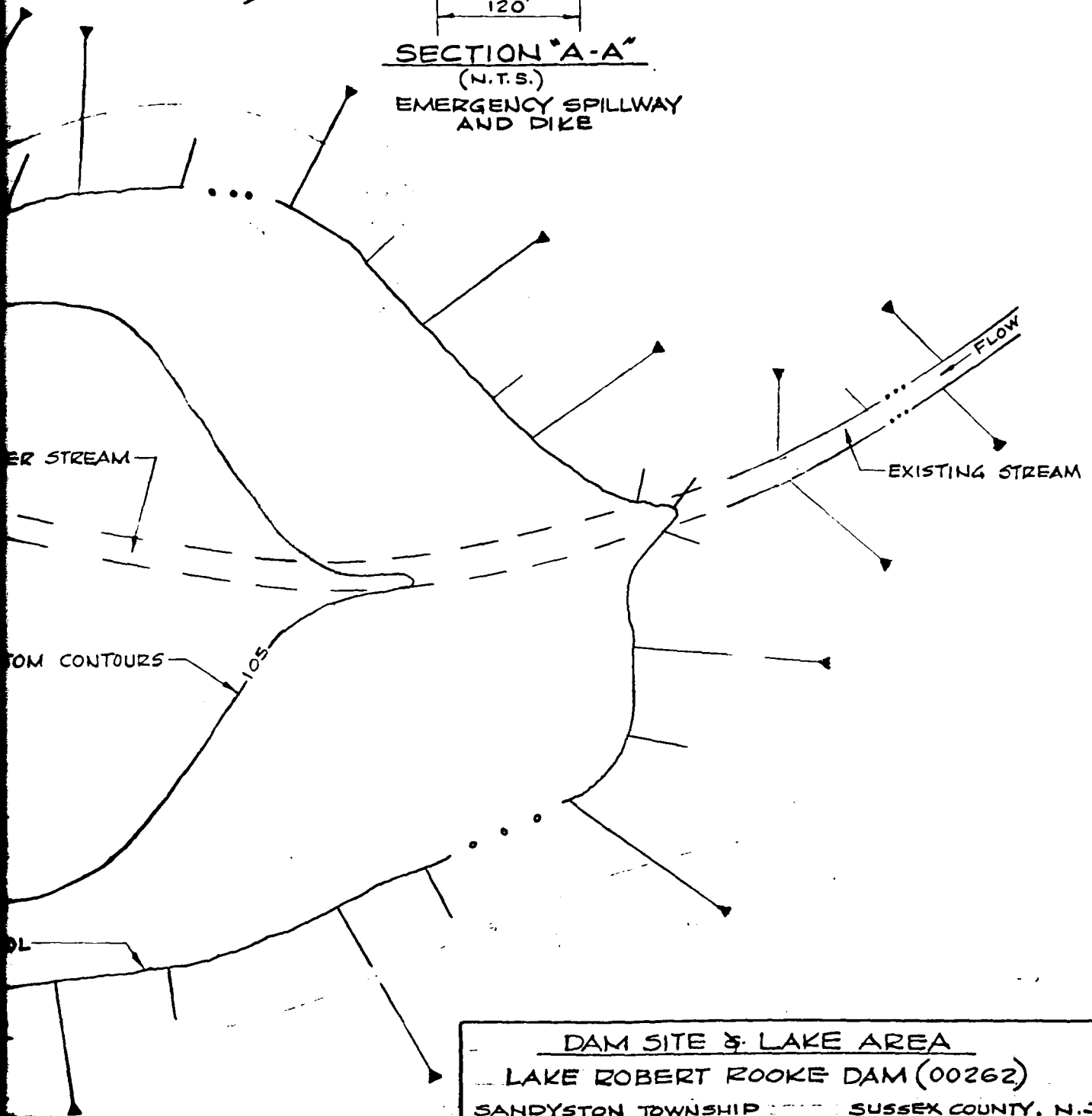


SECTION "A-A"
(N.T.S.)
EMERGENCY SPILLWAY AND DIKE

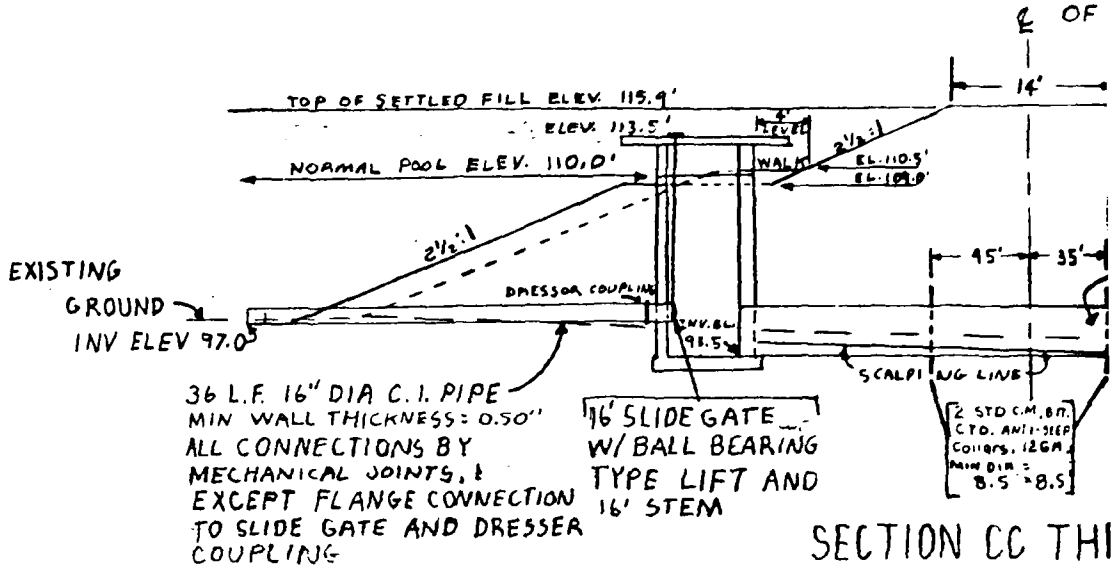


KETCHES ADAPTED FROM DESIGN DRAWINGS FOR "NEWARK Y.M.C.A. DAM" BY U.S. DEPT. OF AGRICULTURE SOIL CONSERVATION SERVICE DATED 1963. (N.J. 625 P)
LL ELEVATIONS ARE PLAN ELEVATIONS USING AN ARBITRARY DATUM.

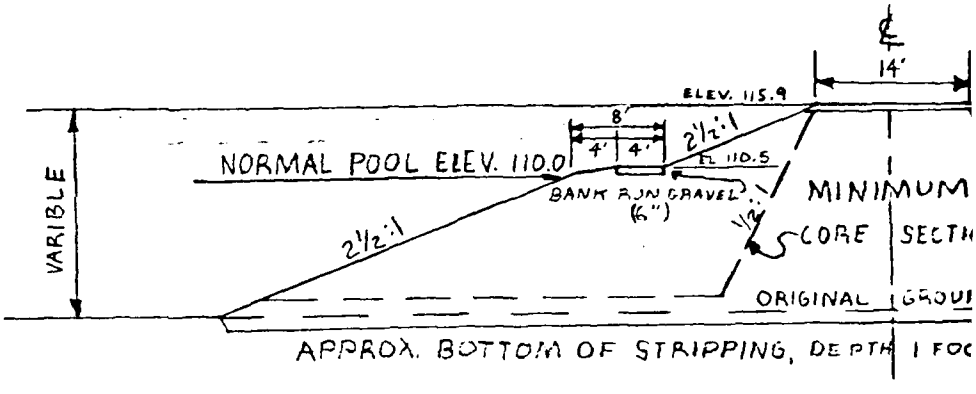
DAM SITE & LAKE AREA
LAKE ROBERT ROOKE DAM (00262)
SANDYSTON TOWNSHIP SUSSEX COUNTY, N.J.

LANGAN ENGINEERING ASSOCIATES, INC.
990 CLIFTON AVENUE CLIFTON, N.J. 07013

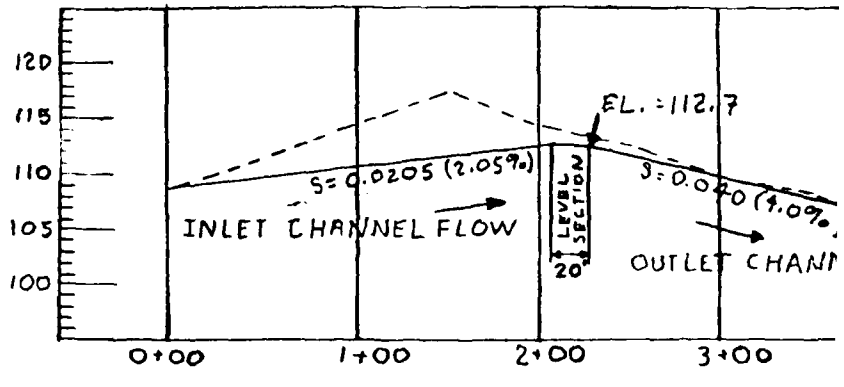
DRN. BY: Mark Fadel	SCALE: NTS	JOB No. 80145
CK'D. BY:	DATE: 8 SEPT 80	FIG. No. 2



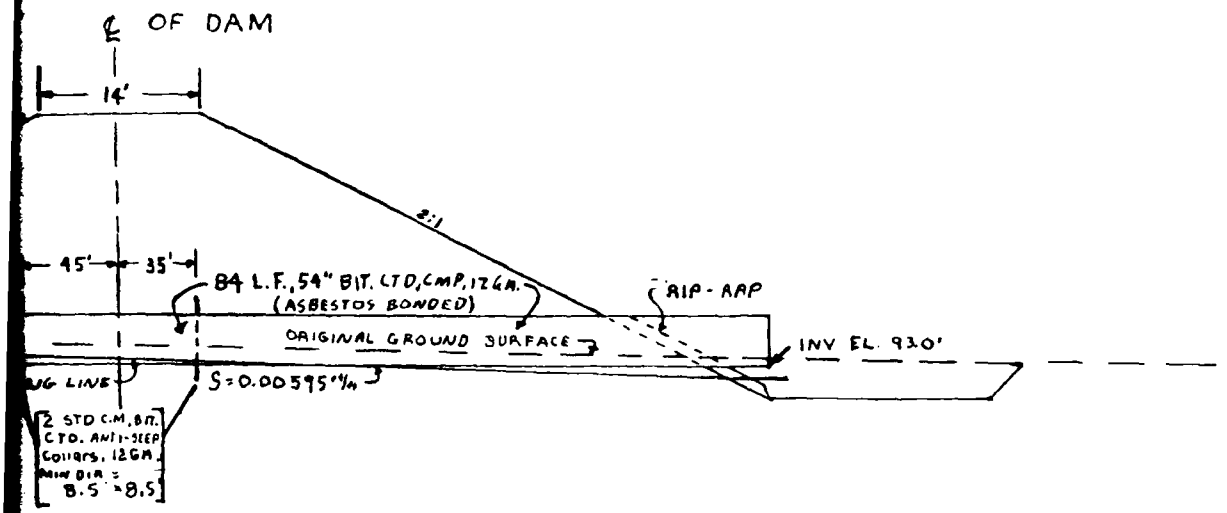
SECTION CC THI



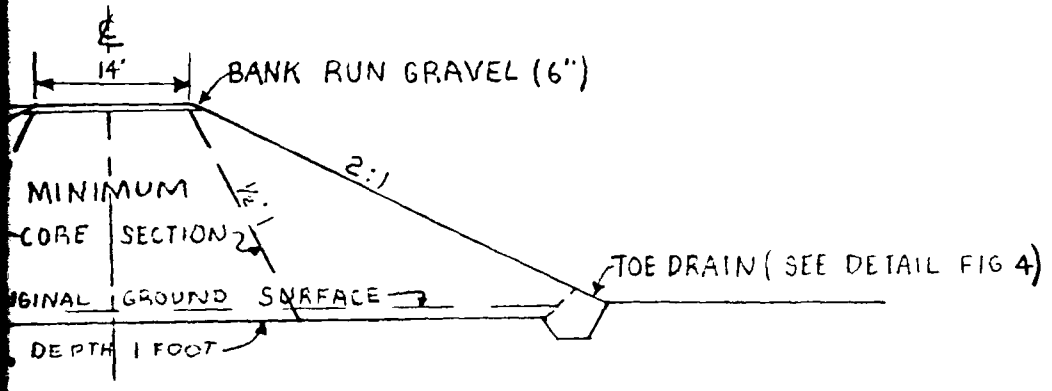
SECTION BB - TYPICAL EM



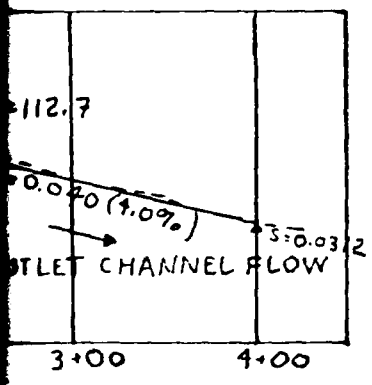
PROFILE & EMERGENCY SPILLWA



N CC THRU ℄ OF PRINCIPAL SPILLWAY



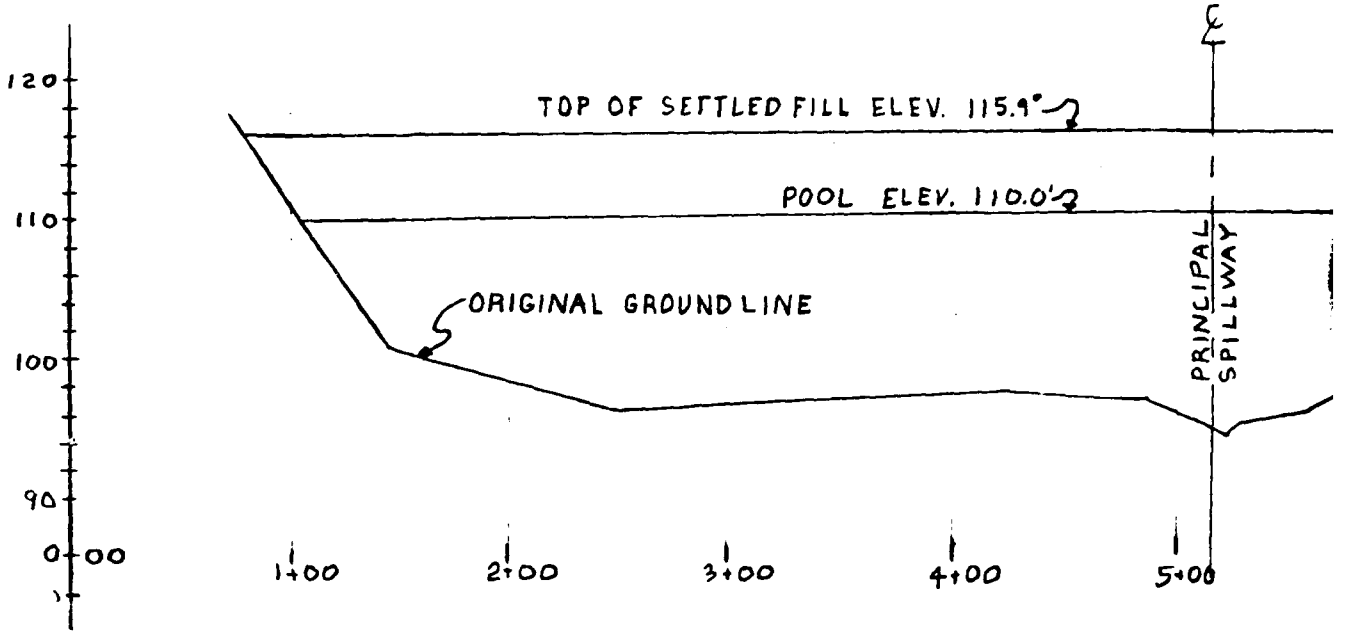
YPICAL EMBANKMENT SECTION



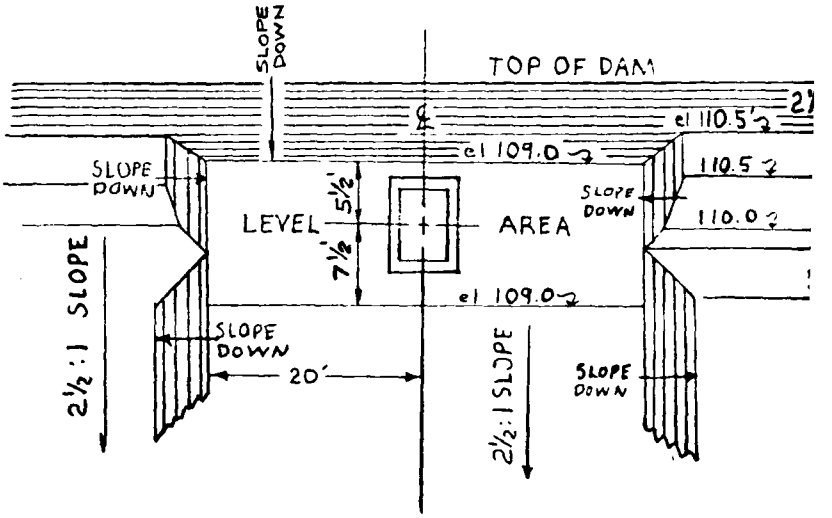
SPILLWAY

NOTES:
1. SKETCHES ADAPTED FROM DESIGN DRAWINGS FOR "NEWARK Y.M.C.A. DAM" BY U.S. DEPT. OF AGRICULTURE SOIL CONSERVATION SERVICE DATED 1963 (N.J. 625 P)
2. ALL ELEVATIONS ARE PLAN ELEVATIONS USING AN ARBITRARY DATUM

DAM SECTIONS & EMERG. SPILLWAY PROFILE		
LAKE ROBERT ROOKE DAM (00262)		
SANDYSTON TOWNSHIP — SUSSEX COUNTY, N.J.		
LANGAN ENGINEERING ASSOCIATES, INC.		
990 CLIFTON AVENUE CLIFTON, N.J. 07013		
DRN. BY: Mark Field	SCALE: NTS	JOB No. 80145
CK'D. BY:	DATE: 9 SEPT 80	FIG. No. 3



PROFILE ALONG ℄ OF DAM LO(



PLAN OF BERM AROUND RISER

NOTES:
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FOR "NEWARK Y
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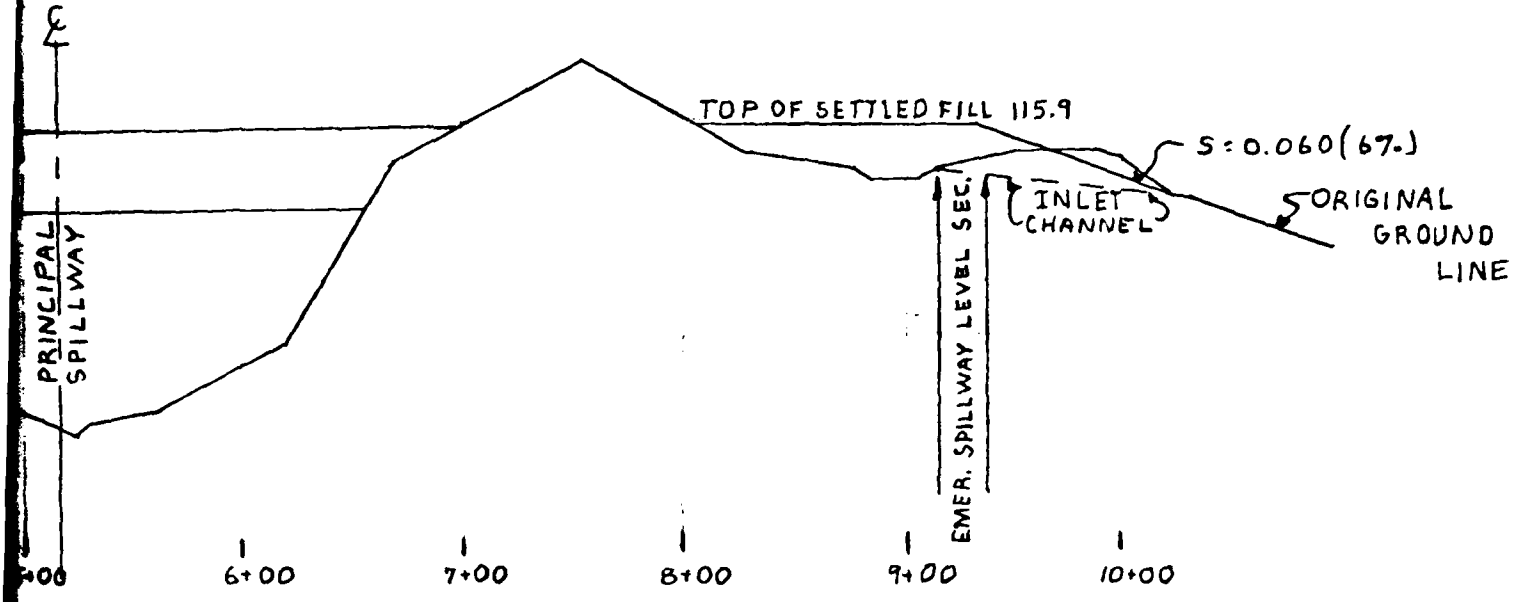
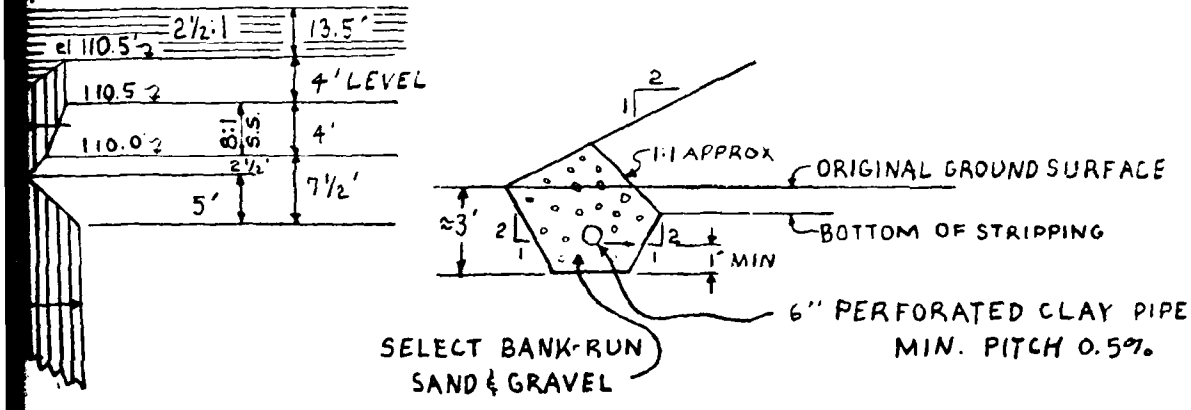
2. ALL ELEVATIONS
USING AN ARBI



DAM LOOKING DOWNSTREAM



TOE DRAIN DETAIL

RISER

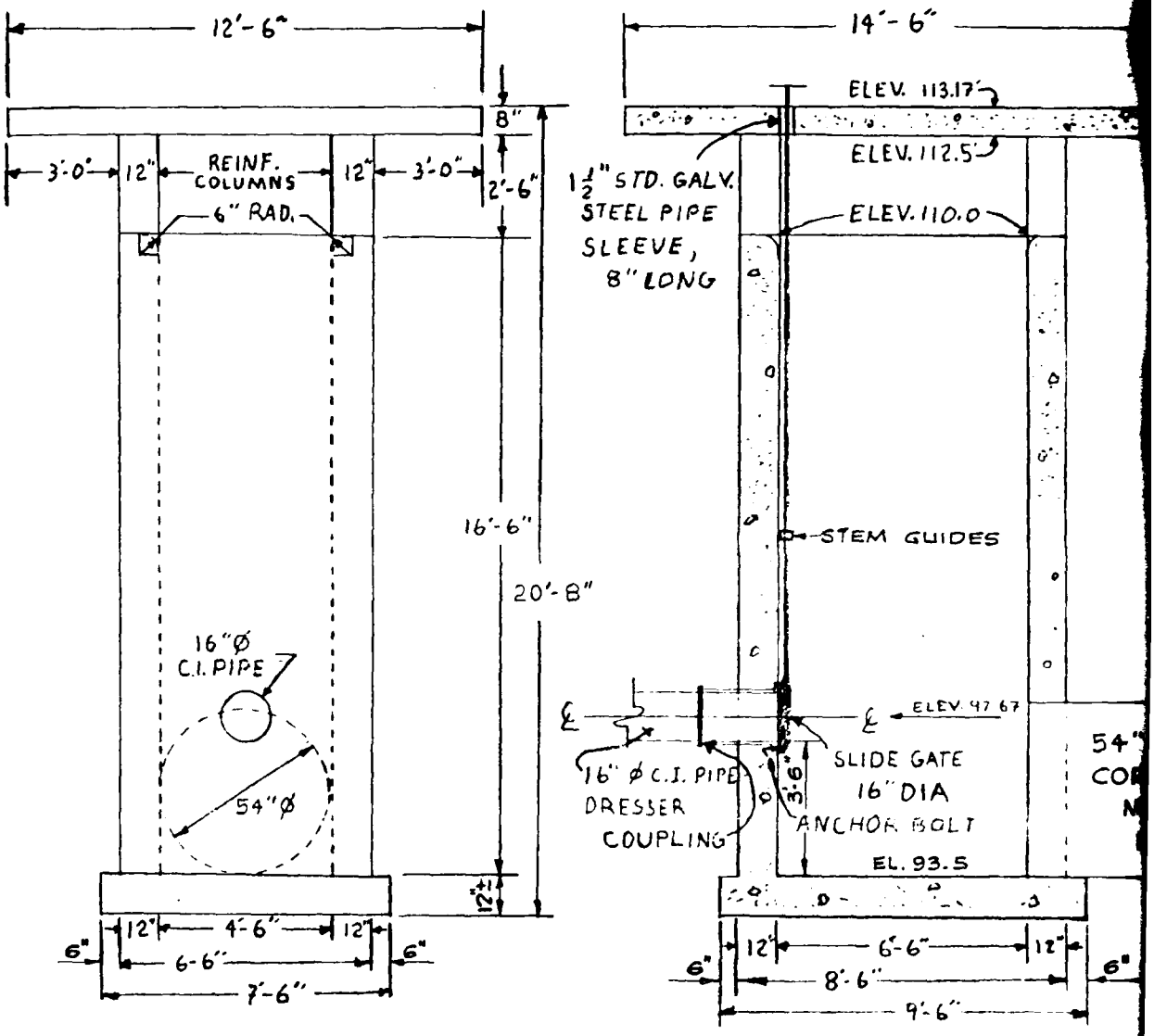
GES ADAPTED FROM DESIGN DRAWINGS NEWARK Y.M.C.A. DAM" BY U.S. DEPT. OF ULTURE SOIL CONSERVATION SERVICE 1963. (N.J. 625 P) EVATIONS ARE PLAN ELEVATIONS AN ARBITRARY DATUM.

℄ PROFILE OF DAM, PLAN OF RISER BERM AND TOE DRAIN DETAIL
LAKE ROBERT ROOKE DAM (00262)
SANDYSTON TOWNSHIP SUSSEX COUNTY, N.J.

LANGAN ENGINEERING ASSOCIATES, INC.
990 CLIFTON AVENUE CLIFTON, N.J. 07013

DRN. BY: Mark Todd	SCALE: NTS	JOB No. 80145
CK'D. BY:	DATE: 9 SEPT 80	FIG. No. 9

1 2



SLIDE GATE REQUIREMENTS AS SPECIFIED IN THE ORIGINAL DRAWING

1. 16" DIA. HEAVY DUTY, ARMCO MODEL 55020C OR EQUAL.
2. SEATING HEAD 0 FT.
3. UNSEATING HEAD 18 FT.
4. OPERATING HEAD 15 FT.
5. CAST IRON SEAT, SLIDE, LIFT NUTS & HAND WHEEL.
6. FLANGE BACK WITH ANCHOR BOLTS.
7. MACHINE & DRILL BACK OF FLANGE TO CONNECT WITH 16" DIA. C.I. PIPE.
8. LIFT TYPE HANDWHEEL, ARMCO MODEL H-14 OR EQUAL.
9. STEM SIZE - 7/8" DIA.
10. STEM LENGTH - 16 FT FROM ℄ OF GATE.
11. USE ADJUSTABLE STEM GUIDES.

NOTES:
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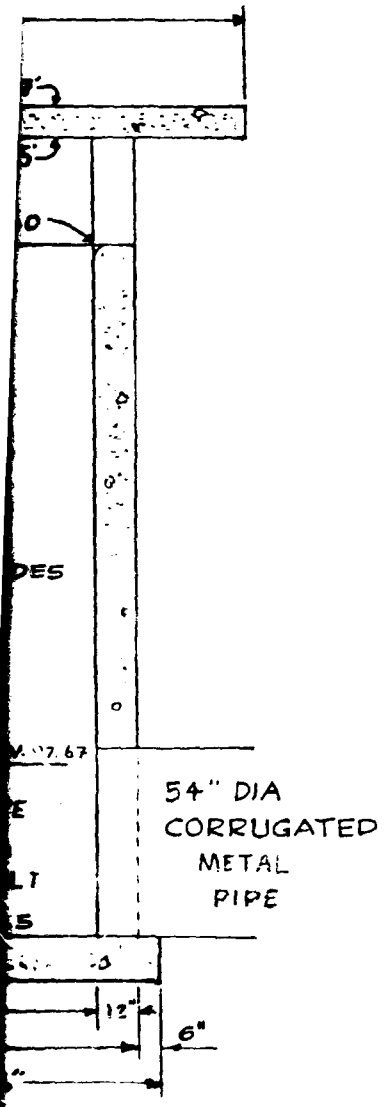
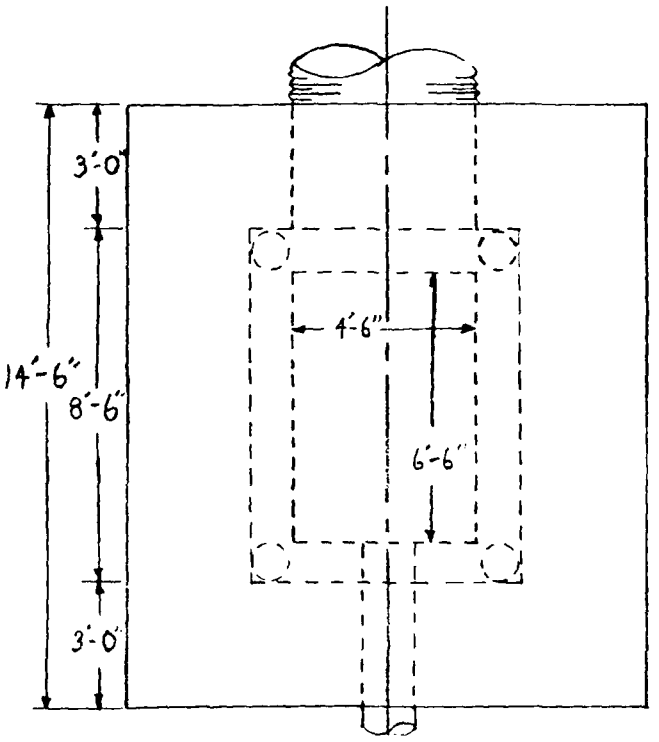




TOP SLAB
PLAN VIEW

DROP INLET · SPILLWAY DETAILS
LAKE ROBERT ROOKE DAM (00262)

SANDYSTON TOWNSHIP SUSSEX COUNTY, N.J.

LANGAN ENGINEERING ASSOCIATES, INC.

990 CLIFTON AVENUE CLIFTON, N.J. 07013

DRN. BY: Mark Judd	SCALE: N.T.S.	JOB No. 80145
CK'D. BY:	DATE: 9 SEPT. 80	FIG. No. 5

TES:
1. SKETCHES ADAPTED FROM DESIGN DRAWINGS FOR "NEWARK Y.M.C.A. DAM" BY U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE DATED 1963 (N.J. 625 P)
2. ALL ELEVATIONS ARE PLAN ELEVATIONS USING AN ARBITRARY DATUM.

APPENDIX 1

a. Preliminary Report, Soil and Foundation Investigation and Design, Newark YMCA Dam, Sandyston Township, New Jersey, by Woodward-Clyde-Sherard and Associates, 18 June 1963.

b. Design Report N.J.-625-R by U. S. Department of Agriculture, Soil Conservations Service, 1963.

c. Pertinent Design Calculations.

d. Report on Dam Inspection, Newark YMCA Dam, Dam Application No. 564, by Mr. John H. O'Dowd, Supervising Engineer, New Jersey Division of Water Policy and Supply, 2 October 1963.

e. Final Report, Construction Inspection, Newark YMCA Dam, Sandyston Township, New Jersey, by Woodward-Clyde-Sherard and Associates, 14 July 1980.

f. Letter from Joseph H. Partenheimer, Vice President YM-YWCA of Newark and Vicinity, to Mr. George R. Shanklin, Chief Engineer and Director, New Jersey Division of Water Policy and Supply, 11 January 1967.

OAKLAND CALIFORNIA
SAN DIEGO CALIFORNIA

DENVER COLORADO

NEW YORK NEW YORK

WOODWARD-CLYDE-SHERARD AND ASSOCIATES
SOIL AND FOUNDATION ENGINEERING
88 GREENWOOD AVENUE
MONTCLAIR, NEW JERSEY

CABLE "WOODWYDE NEWYORK"

TELEPHONE PILGRIM 6-0000

June 18, 1963
63M83

Newark YM - YWCA
600 Broad Street
Newark 2, New Jersey

RECEIVED

Attention: Mr. Louis R. Briegel
Secretary

Preliminary Report
Soil and Foundation Investigation and Design
Newark YMCA Dam
Sandyston Township, New Jersey

Gentlemen:

Submitted herewith is our preliminary report on the soil and foundation investigation made for the proposed YMCA Dam. This work has been done in accordance with Stage I of our proposal dated April 16, 1963 and was authorized by you on April 26, 1963.

We look forward to working with you on the final design phase of this project.

Yours very truly,
WOODWARD-CLYDE-SHERARD & ASSOCIATES

Herbert L. Lobdell, P.E.

David M. Greer, P.E.

HLL:esch
Submitted: 5 copies

PRELIMINARY REPORT
SOIL AND FOUNDATION INVESTIGATION AND DESIGN
NEWARK YMCA DAM
SANDYSTON TOWNSHIP, NEW JERSEY

Report to
Newark YM - YWCA
Newark 2, New Jersey

WOODWARD-CLYDE-SHERARD & ASSOCIATES

INTRODUCTION

Following preliminary studies by the Soil Conservation Service which included hydrology, topography, spillway design, and test pits, our office was engaged to further investigate subsurface conditions in the area of the proposed dam and to develop preliminary designs and cost estimates.

A progress letter was submitted on May 16, 1963, in which the subsurface conditions encountered as of that date were described.

SCOPE OF STUDY

This investigation has included the following:

1) an airphoto soil and geologic analysis of the area;

2) borings, test pits, and a seismic refraction survey at the dam site;

3) test pits in potential borrow areas;

4) analysis of conditions and general recommendations pertaining to the dam design; and

5) a preliminary cost estimate for the project.

FIELD INVESTIGATION

Two borings were made along the center line of the proposed dam where shown on Plate 2. Both of these borings were cored five feet into bedrock.

Seismic refraction lines were run both along the center line and at right angles to the center line, for the purpose of locating the depth of bedrock, and to correlate the general distribution and characteristics of the subsoils in the valley with those found in the borings.

Test pits to depths of about 6 to 8 feet were dug both by the Soil Conservation Service and our personnel at the dam site. The location of these pits are shown on Plate 2.

Test pits were also dug by our personnel upstream from the small lake at Camp McDonald where consideration is being given to extending the lake and at the same time utilizing this material for the dam. Other test pits were dug about 500 to 700 feet east of the entrance to Camp Linwood, and just to the north of Flat Brook Road in the search for potential embankment material.

Descriptions of the materials encountered in the borings and test pits are shown in the logs, Plates 7 through 13. A key to soil symbols is presented as Plate 6.

The seismic velocities, which are indications of the density and nature of the materials explored by this method are noted on the profiles, Plates 3 and 4.

GENERAL SUBSURFACE CONDITIONS AT DAM SITE

A generalized subsurface profile across the dam site is presented as Plate 3.

The borings and seismic refraction survey revealed rock to be at a depth of about 10 feet below the surface at the north slope of the valley, then gradually dropping off to a maximum depth of 35 to 40 feet across the southern half of the valley. The soil overburden is essentially composed of a dense glacial "till", which according to examination of the samples and grain size curves, is a well-graded silty gravelly coarse to fine sand with varying amounts of cobbles and boulders. The percentage of silt fines in the till appears to generally vary from about 10 to 15%, although one sample indicates that there are probably localized zones with smaller amounts of silt.

There is about one foot of topsoil (organic matter and roots) over the general area. Below the topsoil there is generally found two or three feet of impervious material, consisting of stiff silty clays or fine sandy clayey silts.

The average depth to groundwater is three to four feet below the valley floor.

LABORATORY TESTING

Six grain-size analyses were run on representative samples of foundation materials at the dam site, and one grain-size test was run on a sample of good potential embankment core material to serve as a check on visual classification. In addition, two moisture contents and two sets of Atterberg Limits were run on samples of fine-grained soils. These results are shown on Plates 14 and 15.

DISCUSSION AND RECOMMENDATIONS

General Design Criteria - The following elevations have tentatively been established which satisfy the requirements of the State of New Jersey :

Crest Elevation :	117.2
Design High Water Level:	115.4
Normal Water Level:	110.0

Evaluation of Dam Foundation Soils - The main problem in this investigation has been to determine if the soils beneath the valley floor are sufficiently impervious to prevent any large-scale leakage beneath the dam. The percentage of fines (10 - 15% silt) found in the typical dense, well-graded till samples is enough to make this stratum generally semi-impervious. There is the possibility of localized pervious zones or lenses in such a mass of material, which could conceivably cause large-scale, troublesome leakage; but the chances of such leakage are believed to be remote. The impervious soil mantle which blankets the valley floor should act as a protective barrier against subsurface leakage. Based on an evaluation of these factors, it is our opinion that conditions are favorable for the construction of the dam and that it can be built economically, without resorting to expensive cutoff walls or trenches.

Embankment Design - On Plate 5 are shown tentative typical sections for the proposed dam which we believe will produce an economical, stable, and relatively impervious structure. The final design will depend upon further exploration and availability of borrow materials.

No cutoff trench has been provided in the embankment design because construction of such a trench would require breaking through the im-

pervious mantle that now exists, and the use of well-points during construction because of the high water table. The expense of such a cutoff trench would be great relative to the cost of the entire project; and the reduction in seepage which it would accomplish would only be nominal unless the trench was taken to a considerable depth. A mud slurry cutoff trench to rock would be very effective, as a cutoff wall, but would cost more than the embankment itself. Therefore, it is recommended that the embankment be constructed as shown after the topsoil has been stripped off; and that care be taken in construction, to permit only a minimum of disturbance to the upper impervious mantle.

The purpose of the toe drain shown in the tentative sections is to collect such seepage as does find its way through the dam, and some of the foundation seepage as well, thus maintaining a relatively dry surface outside the toe of the dam.

Borrow Sources - The material encountered upstream from the small lake at Camp McDonald is very gravelly and contains many cobbles and boulders. By the time this material is excavated from below the water level (which is necessary if the lake is going to be extended), much of the fine-grained soil present in it will be washed out. Therefore, soil from this source will be suitable for "random" pervious fill, but cannot be used for core material.

The material found just to the north of Flat Brook Road and across the ridge from the proposed lake is a gravelly, sandy, slightly clayey silt (see grain-size curve on Plate 15, TP - L1) which is excellent core material.

It is planned to explore other sources within the property, including the upstream section of the proposed lake. This source would involve a short haul and no destruction of woodland; but it should be pointed out that there is a danger of opening seepage channels in the valley floor which could lead to large seepage losses. It is our opinion at this time that the valley floor should be left untouched.

Before final selection of borrow areas is made, it appears that the following factors must be carefully weighed:

1) haul distance, which will influence cost;

2) preservation of woodlands;

3) the opportunity to enlarge or deepen the proposed lake by borrowing from it; and

4) the possibility of creating seepage problems if borrow is obtained from within the proposed lake area.

Post-Construction Engineering - As pointed out earlier, a remote possibility exists of large-scale seepage beneath the dam due to localized pervious zones in the foundation soils. For this reason observations should be made during and following the filling of the lake. Should troublesome leakage occur, it may be necessary to completely drain the lake and place a thin blanket of impervious soil over designated areas, through which seepage has developed.

It is recommended that a valve be built into the intake system to permit draining of the lake.

COST ESTIMATE

On Table I is submitted a preliminary cost estimate for the project.

FUTURE INVESTIGATION

It is believed that additional borings at the dam site will not reveal conditions that would alter present recommendations; and, therefore, they are considered unnecessary in the event it is decided to go ahead with the project. Future field work should be devoted to further exploration of borrow sources so that the type and amounts of materials to go into the embankment will be established for design purposes, and to define borrow areas well in advance of construction.

A final report will include typical sections, more detailed recommendations, laboratory tests for compaction criteria, and specifications for construction of the embankment.

At this time we wish to stress the importance of supervision of construction by a competent soil engineer. An important and necessary duty of a soil engineer during construction will be to observe and report on soil conditions in the field, particularly in regard to foundation preparation, stripping, and borrow areas within the lake area (if any). This is imperative to provide a basis for corrective measures, if leakage should occur.

TABLE I

COST ESTIMATE

1) Embankment		
25,700 cubic yard @ $ 1.00/c.y.		$ 25,700.00
2) Stripping		
3150 cubic yard @ $ 0.50/c.y.		1,600.00
3) Toe Drain		
600 ft. 6" Perforated pipe @ $ 2.75/1.ft.		1,700.00
Filter stone 71 cubic yard @ $ 6.50/c.y.		500.00
Select sand and gravel 290 cubic yard @ $ 3.00/c.y.		850.00
4) Seeding		
2630 square yard @ $ 0.30/sq.y.		800.00
5) Spillway (Closed Conduit)		6,800.00
6) Emergency Spillway		1,000.00
7) Seal off and divert brook		500.00
	Total:	$ 39,450.00

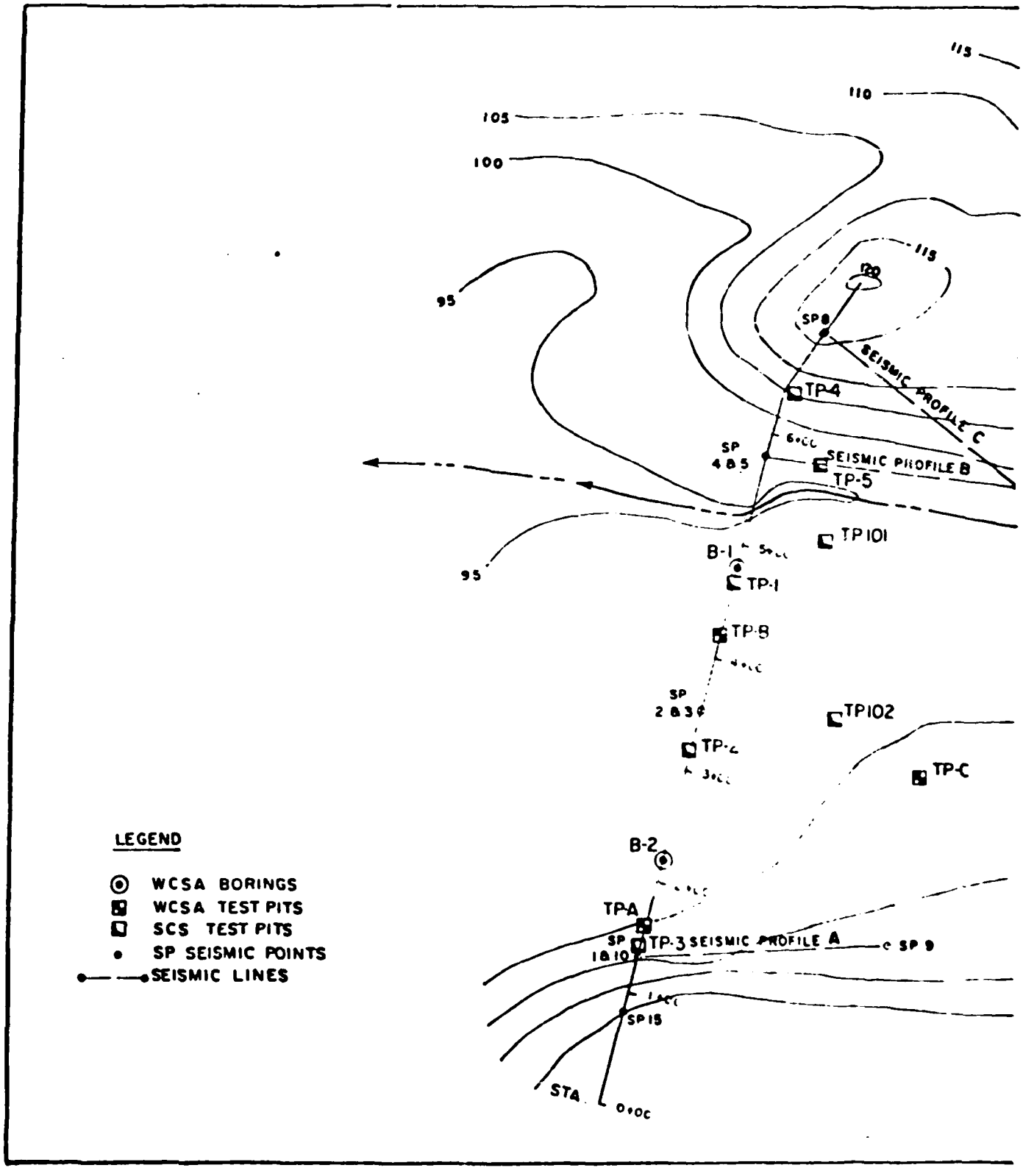
SITE LOCATION MAP

PROPOSED NEWARK YMCA DAM
SANDYSTON TWP., SUSSEX CO., N J

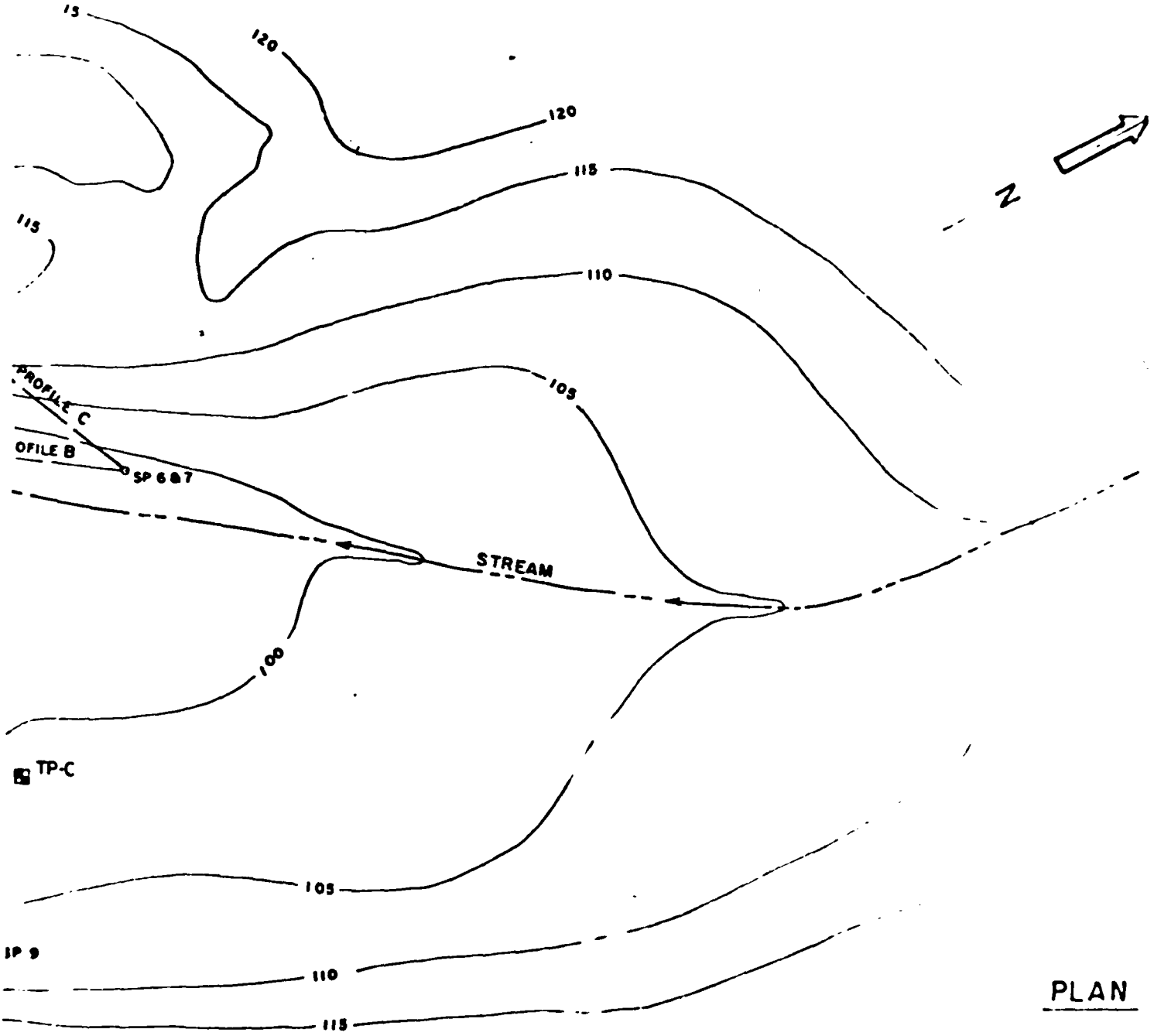
SCALE 1" = 2000'

PLATE 1

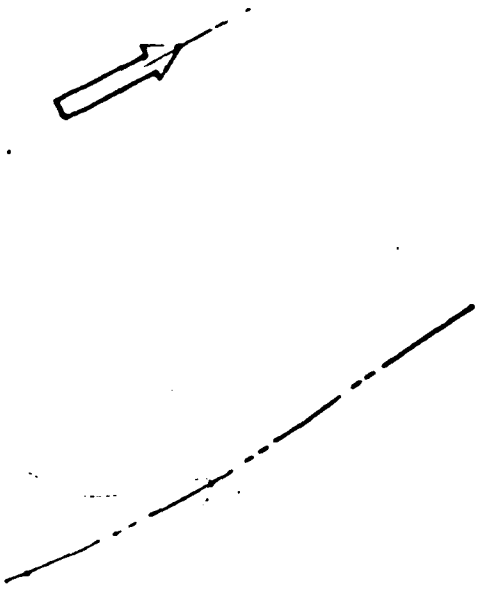
83 M 83


115
110
105
100
95
115
SP 8
SEISMIC PROFILE C
TP-4
SP 4 & 5
SEISMIC PROFILE B
TP-5
TP 101
B-1
TP-1
TP-B
SP 2 & 3
TP 102
TP-C
B-2
TP-A
SP 1 & 10
TP-3
SEISMIC PROFILE A
SP 9
SP 15
STA 0+00
LEGEND
WCSA BORINGS
WCSA TEST PITS
SCS TEST PITS
SP SEISMIC POINTS
SEISMIC LINES

63 M 83


13
120
120
115
115
110
105
PROFILE C
OFILE B
SP 6 & 7
STREAM
100
TP-C
105
IP 9
110
115
N

PLAN

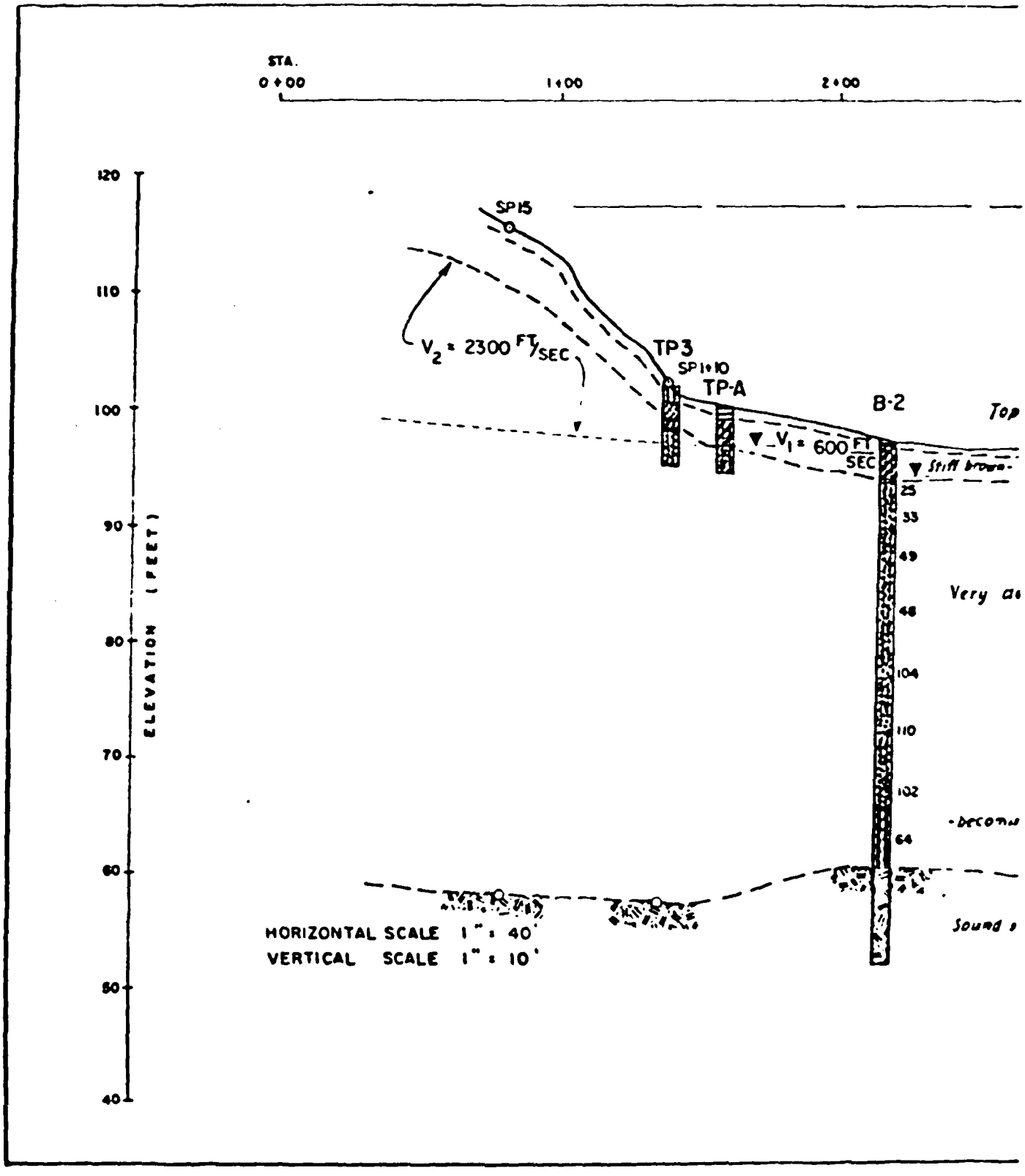


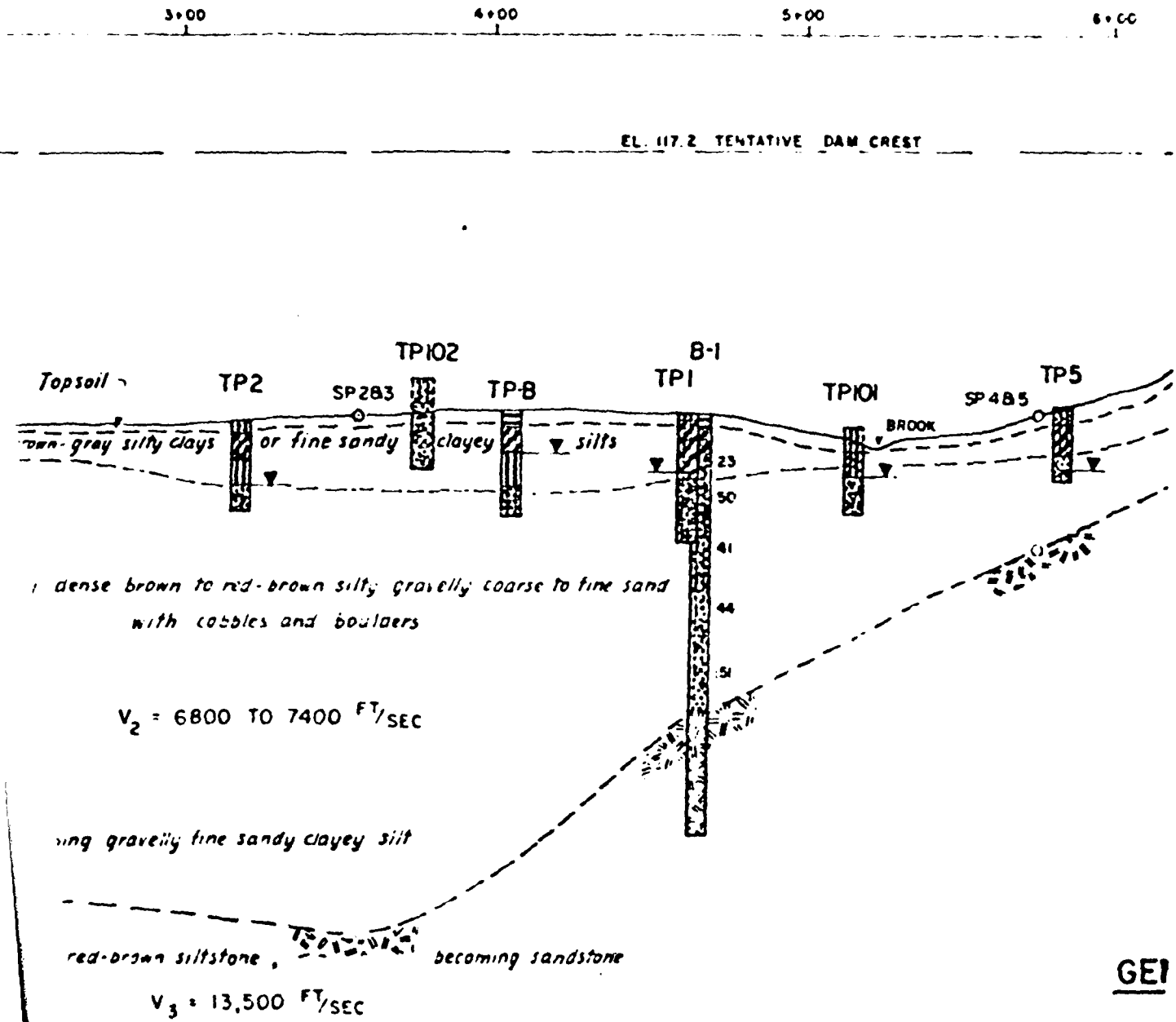
PLAN OF BORINGS, TEST PITS & SEISMIC LINES

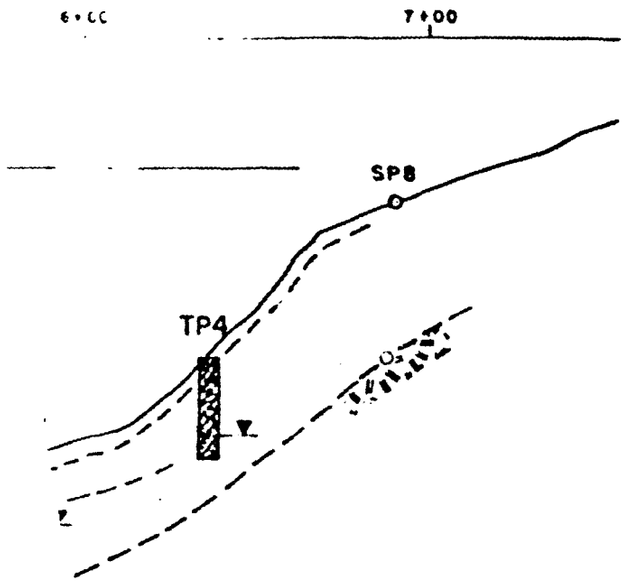
PROPOSED NEWARK YMCA DAM
SANDYSTON TWP, SUSSEX CO, N.J.

SCALE 1" = 100'

PLATE 2


STA.
0+00
1+00
2+00
120
110
100
90
80
70
60
50
40
ELEVATION (FEET)
SP15
V_2 = 2300 FT/SEC
TP3
SP1+10
TP-A
B-2
Top
V_1 = 600 FT/SEC
Stiff brown
25
33
49
Very
48
104
110
102
become
64
Sound
HORIZONTAL SCALE 1" = 40'
VERTICAL SCALE 1" = 10'


3+00
4+00
5+00
6+00
EL. 117.2 TENTATIVE DAM CREST
TP102
B-1
Topsoil
TP2
SP283
TP-8
TP1
TP101
SP485
TP5
BROOK
own-gray silty clays
or fine sandy
clayey
silts
23
50
41
44
51
dense brown to red-brown silty gravelly coarse to fine sand
with cobbles and boulders
V2 = 6800 TO 7400 FT/SEC
ing gravelly fine sandy clayey silt
red-brown siltstone,
becoming sandstone
V3 = 13,500 FT/SEC
GEI



NOTES

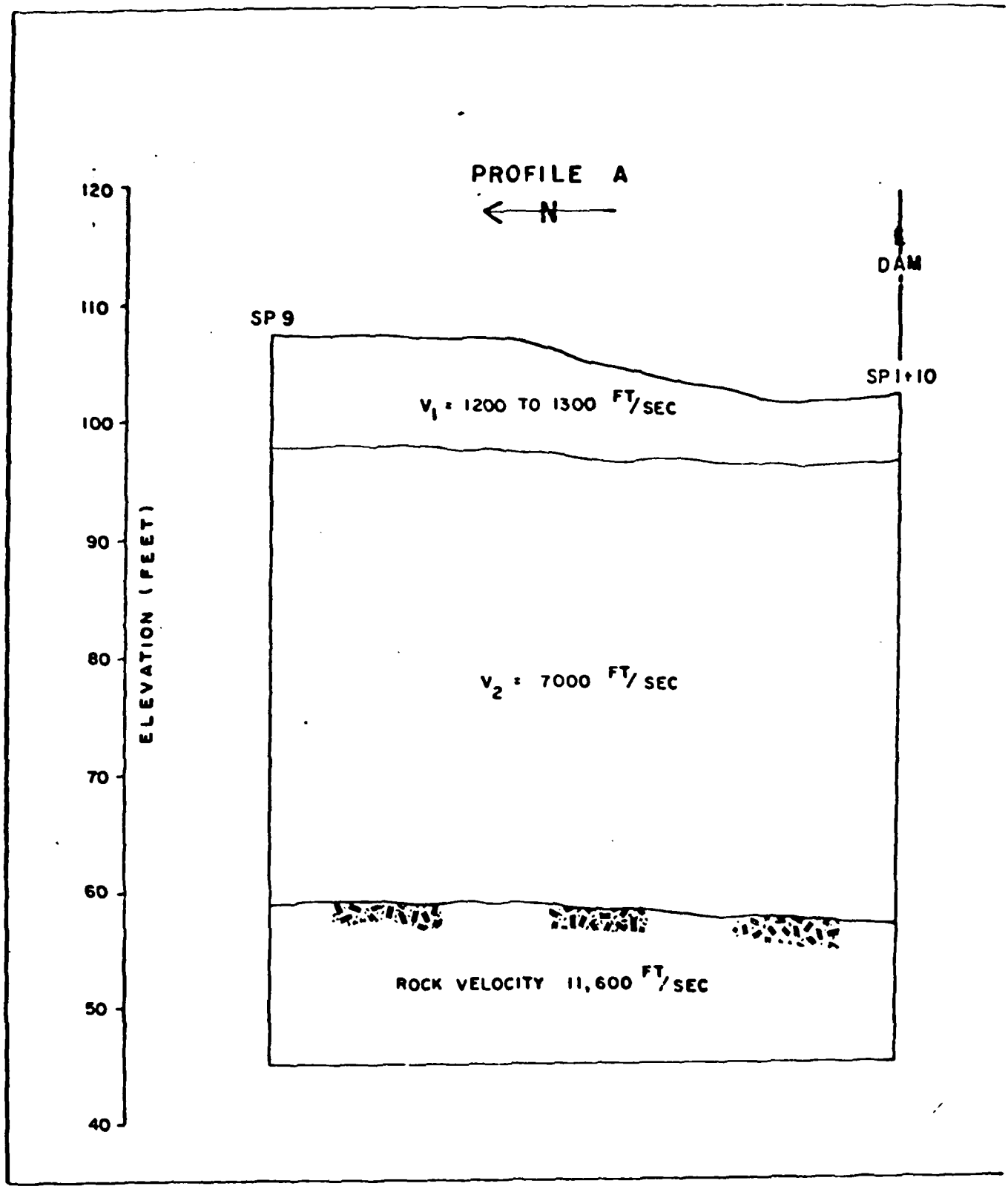
FIGURES NEXT TO BORINGS DENOTE SAMPLING RESISTANCE (SEE KEY, PLATE 6)

SP — SEISMIC POINT

VERALIZED SOIL PROFILE

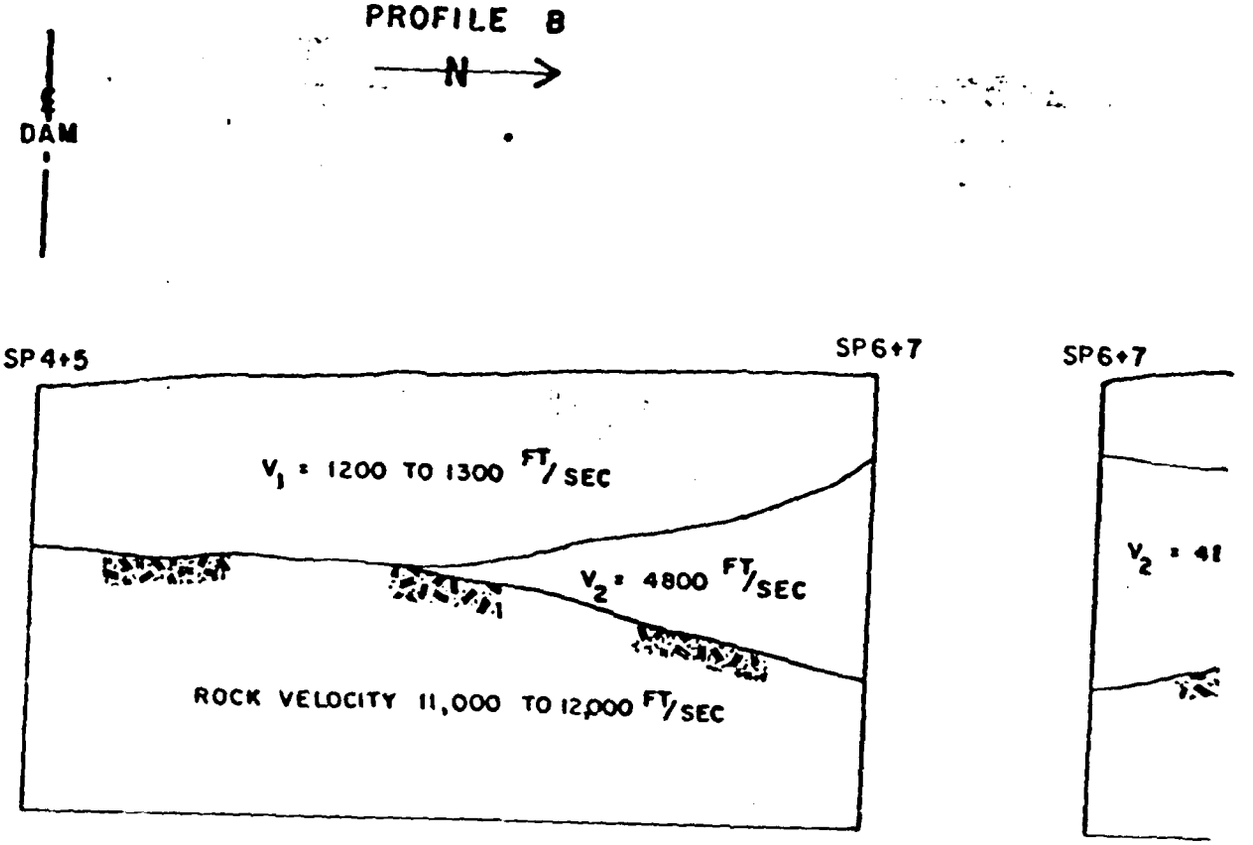
PROPOSED NEWARK YMCA DAM
SANDYSTON TWP, SUSSEX CO, N J

PLATE 3

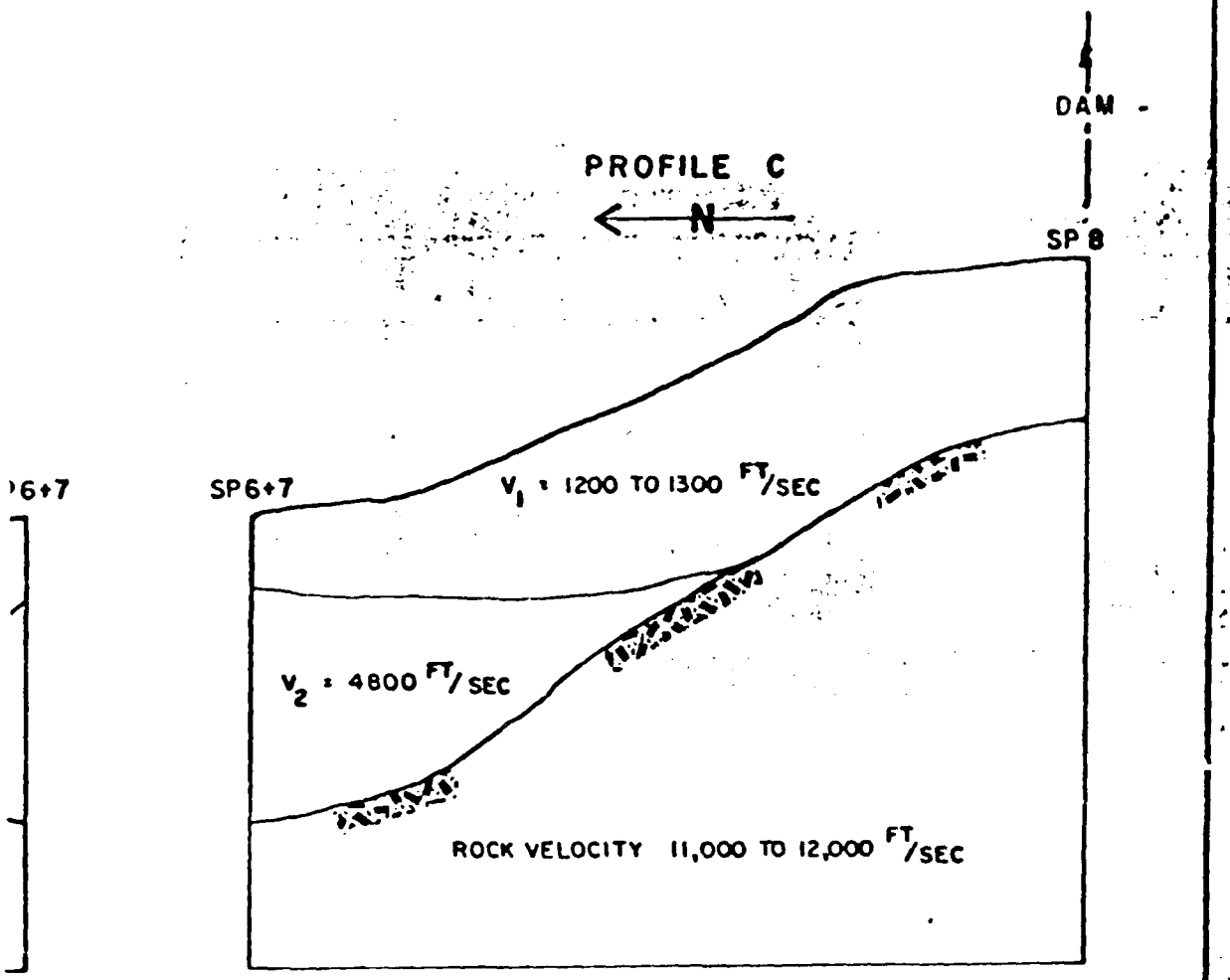

PROFILE A
N
DAM
SP 9
SP 1+10
V_1 = 1200 TO 1300 FT/SEC
V_2 = 7000 FT/SEC
ROCK VELOCITY 11,600 FT/SEC
ELEVATION (FEET)
120
110
100
90
80
70
60
50
40

63 M 83

PROFILE B



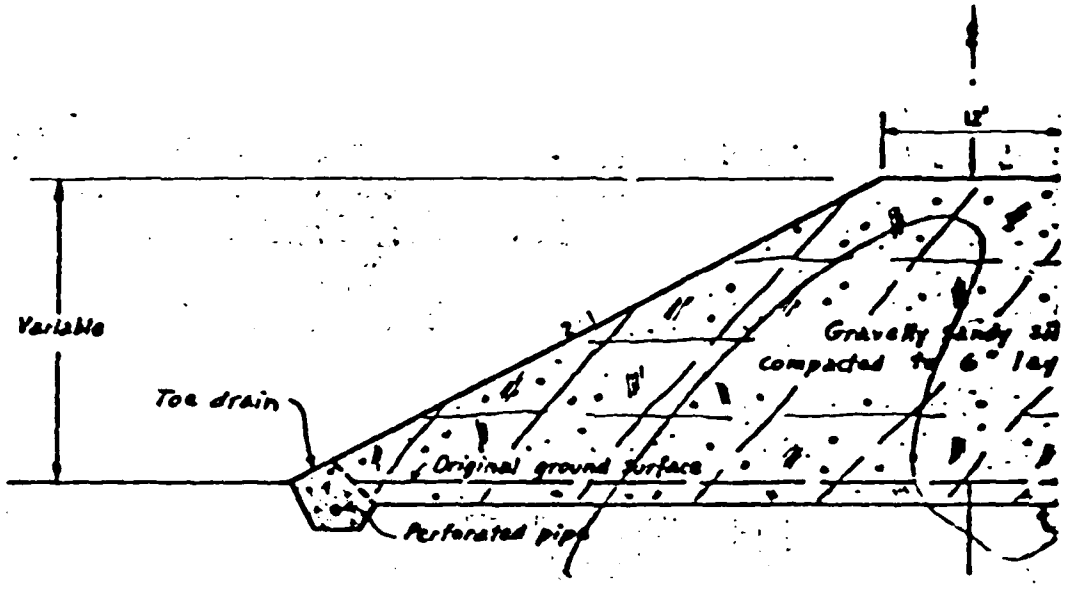
HORIZONTAL SCALE 1" = 40'
VERTICAL SCALE 1" = 10'



SEISMIC PROFILES

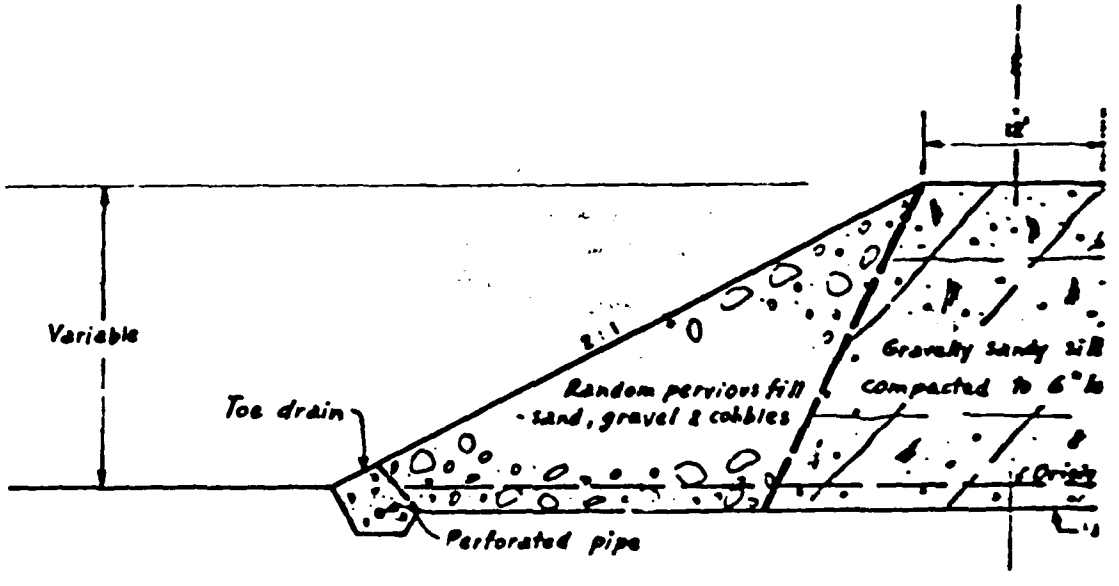
PROPOSED NEWARK YMCA DAM
SANDYSTON TWP., SUSSEX CO., N.J.

PLATE 4



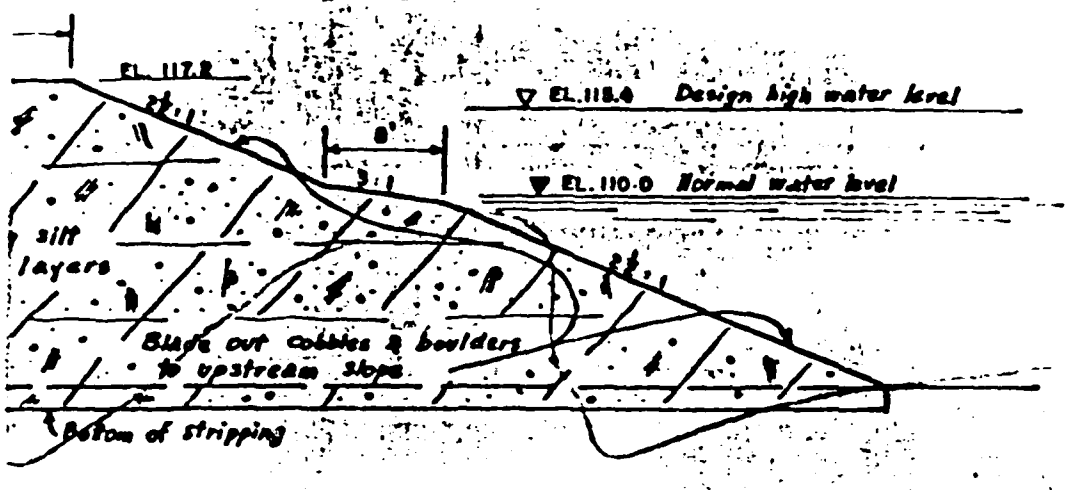
TYPICAL SECT

(PRELIMINARY)



ALTERNATE SE

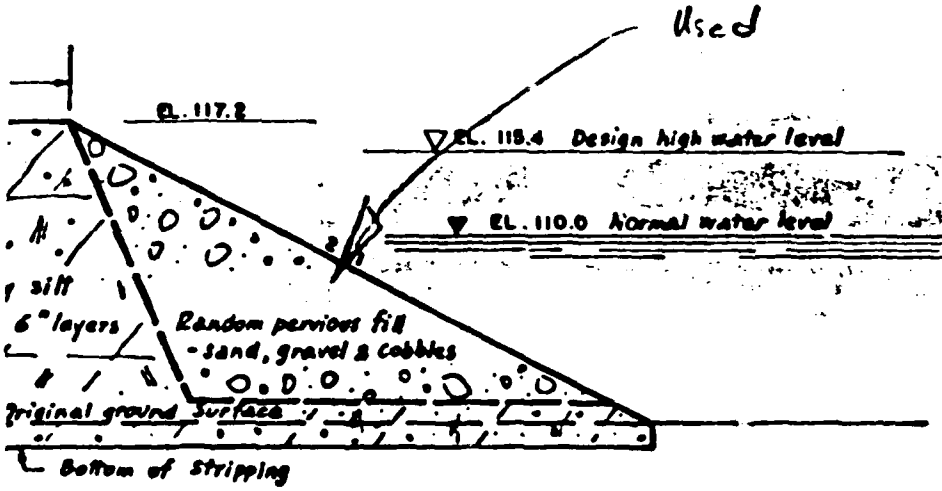
(PRELIMINARY)



CTION

ARY)

HORIZONTAL SCALE 1" = 10'
VERTICAL SCALE 1" = 10'



SECTION

ARY) Used

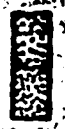
PROPOSED NEWARK YMCA DAM

SANDYSTON TWP., SUSSEX CO., N.J.

PLATE 8

KEY TO SOIL SYMBOLS AND TERMS

Terms used in this report for describing soils according to their texture or grain size distribution are in accordance with the Unified Soil Classification System, as described in Technical Memorandum No. 3-357, Waterways Experiment Station, March 1953.



TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (1) clean gravels and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

Descriptive Term	Relative Density
Very loose	0 to 15%
Loose	15 to 40%
Medium dense	40 to 70%
Dense	70 to 85%
Very dense	85 to 100%

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

Descriptive Term	*Unconfined Compression Strength, tons/sq. ft.	Penetrometer Reading pounds on 0.25 in. dia. area
Very soft	less than 0.25	less than 2.5
Soft	0.25 to 0.50	2.5 to 5.0
Firm	0.50 to 1.00	5.0 to 10.0
Stiff	1.00 to 2.00	10.0 to 20.0
Very stiff	2.00 to 4.00	20.0 to 40.0
Hard	4.00 and higher	40.0 and higher

*Note: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil. The consistency ratings of such soils are based on penetrometer readings.

SAMPLING RESISTANCE

- 15 - The number of blows (15) of a 140-pound hammer falling 30 inches used to drive a 2" O.D. split-barrel sampler for the last 12 inches of penetration.
- 50/2 - Number of blows (50) used to drive the split-barrel a certain number of inches (2).
- WR - Split-barrel advanced by the weight of rods only.
- WH - Split-barrel advanced by the weight of the hammer and rods.
- R - Refusal, sampler could not be advanced further.
- P - 3" O.D. Shelby tube sample.
- P250 - 3" O.D. Shelby tube pushed hydraulically, using a certain pressure (250 psi) to push the last 6 inches.
- PWR - 3" O.D. Shelby tube advanced 24 inches by the weight of rods only.
- Aug. - Auger sample.
- AX - Rock cored with AX core barrel, which obtains a 1-1/8" diameter core.
- NX - Rock cored with NX core barrel, which obtains a 2-1/8" diameter core.
- 65% - Percentage (65) of rock core recovered.
- P_o - Piston sample.

LABORATORY TEST IDENTIFICATION

- C - Consolidation and specific gravity tests performed.
- D - Relative density test performed.
- K - Permeability test performed.
- M - Mechanical (sieve or hydrometer) analysis performed.
- T - Triaxial compression test performed.
- U - Unconfined compression test performed.
- V - Vane shear test performed.

LOG OF BORING NO. 1

DATE 4/29 - 5/1/63 SURFACE ELEV. 97 LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	SYMBOL	DESCRIPTION	Elevation
0					97.0
				Organic matter and roots	
		25		Stiff gray brown silty clay with cobbles	93.5
5		50		Very dense brown silty gravelly coarse to fine sand (Glacial Till)	
10		44			
15		44			
20		151			74.0
25		R AX 79%		Sound red-brown siltstone	
		AX 28%			
30		AX 74%			64.5
35					

COMPLETION DEPTH 32.5' WATER DEPTH 3.4' DATE 5-1-63

SAMPLER: 2-INCH O.D. SPLIT BARREL

PLATE 8

LOG OF BORING NO. 2

DATE 5/2 - 5/3/63 SURFACE ELEV. 97 LOCATION See Plate 8

DEPTH, FEET	SAMPLES	SAMPLING RESISTANCE	SYMBOL	DESCRIPTION	Elevation
0					97.0
				Organic matter	
	Aug			Dense yellow-brown fine sandy silty clay	93.5
		25		Very dense red-brown silty gravelly coarse to fine sand	
		33			
10		49		(Glacial Till)	
		48		-- with many cobbles & boulders, very difficult drilling	
20		104			
		110			
30		102			65.0
				Hard gravelly sandy clayey silt	
		64			60.0
		AX		Limestone with siltstone, sound	
40		96%		-- becoming sound red-brown sandstone	
		92%			
		AX			
		AX			51.5
		95%			
50					

COMPLETION DEPTH 45.5' WATER DEPTH 2.0' DATE 5.3.63

SAMPLER 2-INCH OD SPLIT BARREL

PLATE 8

LOG OF TP-A

DATE 1-1-63 SURFACE ELEV. _____ LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SYMBOL	DESCRIPTION	Moisture Content %	Atterberg Limits
0			Organic matter and roots		
			Light gray brown silty clay with occasional cobbles	27	37 / 20
5			Brown silty gravelly sand and gravel with cobbles		
10					

COMPLETION DEPTH 6' WATER DEPTH 3.0'

LOG OF TP-B

DATE 1-1-63 SURFACE ELEV. _____ LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SYMBOL	DESCRIPTION
0			Organic matter and roots
			Mottled gray brown silty clay
5			Gray fine sandy silt
			Light brown silty gravel and sand
10			

COMPLETION DEPTH 8' WATER DEPTH 3.0'

PLATE 9

LOG OF TP-C

DATE 1-1-63 SURFACE ELEV. _____ LOCATION See Plate 2

DEPTH, FEET	SAMPLES	SYMBOL	DESCRIPTION
0			Topsoil
			Light brown gravelly clayey silt
5			Gray to brown gravelly coarse to fine sand with occasional cobbles
10			

COMPLETION DEPTH 6' WATER DEPTH 3.0'

LOG OF

DATE _____ SURFACE ELEV. _____ LOCATION _____

DEPTH, FEET	SAMPLES	BLOWS PER INCHES	SYMBOL	DESCRIPTION

COMPLETION DEPTH _____ WATER DEPTH _____

PLATE 10

LOG OF TP-L1

DATE _____ SURFACE ELEV. _____ LOCATION About 500 feet east of Camp entrance and 100'n. of Flat Brook Road

DEPTH, FEET	SAMPLES	SYMBOL	DESCRIPTION
0			Topsoil and roots
5			Light brown gravelly sandy slightly clayey silt with occasional cobbles and boulders
10			

COMPLETION DEPTH 12 WATER DEPTH _____

LOG OF TP-L2

DATE _____ SURFACE ELEV. _____ LOCATION About 700 feet east of Camp entrance and 150' n. Flat Brook Road

DEPTH, FEET	SAMPLES	SYMBOL	DESCRIPTION	Moisture Content %	Atterberg Limits
0			Topsoil		
5			Light brown gravelly sandy slightly clayey silt with occasional cobbles and boulders	15	21/16
10					

COMPLETION DEPTH 10' WATER DEPTH _____

PLATE 11

LOG OF TP-M 3

About 500' east of Camp McDonald Pond (north side)

DATE 5-31-63 SURFACE ELEV. _____ LOCATION _____

DEPTH, FEET	SAMPLES	SYMBOL	DESCRIPTION
0			Top 4' previously excavated
5			Gravelly coarse to fine sand with frequent cobbles and boulders
10			

COMPLETION DEPTH 8' WATER DEPTH _____

LOG OF TP-M 4

About 300 feet above Camp McDonald Pond (south side)

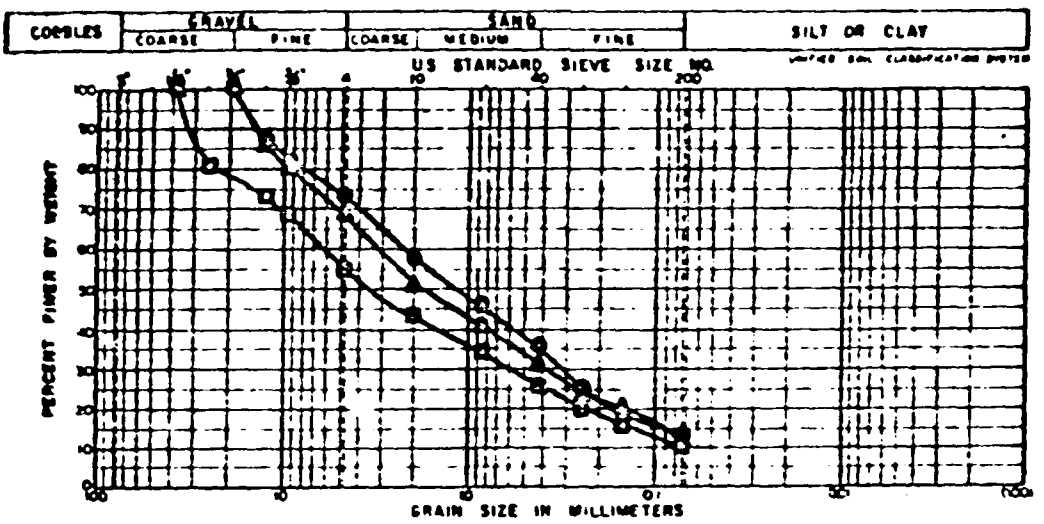
DATE 5-31-61 SURFACE ELEV. _____ LOCATION _____

DEPTH, FEET	SAMPLES	SYMBOL	DESCRIPTION
0			Topsoil
			Brown gravelly sandy clayey silt with cobbles
5			Sand and gravel with frequent cobbles and boulders
10			

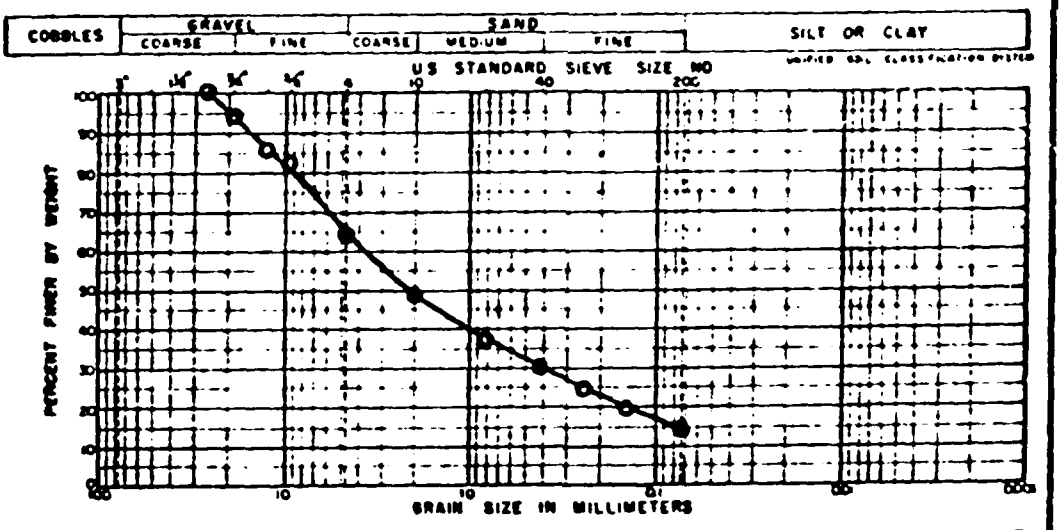
COMPLETION DEPTH 6' WATER DEPTH 2'

PLATE 13

MECHANICAL ANALYSIS



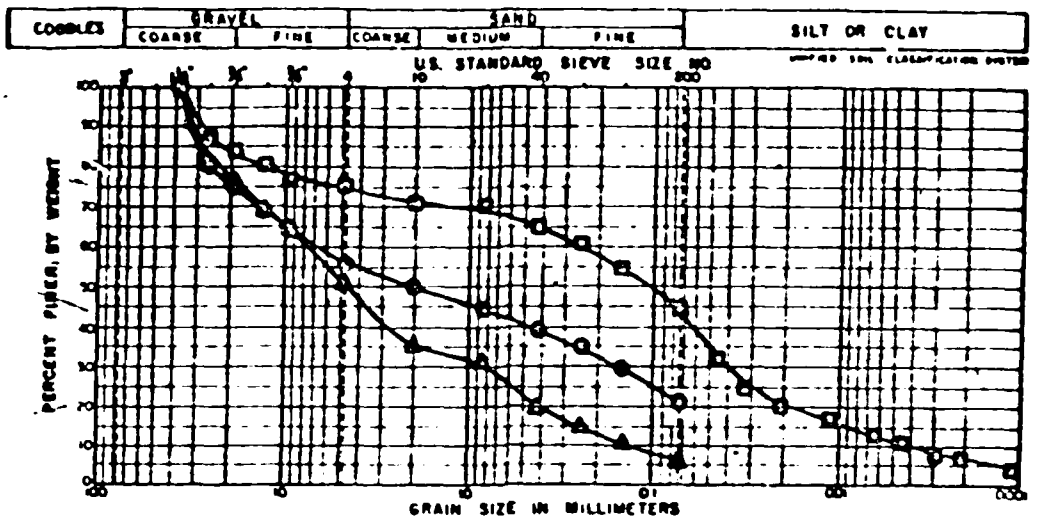
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	WC	LL	PL
1	2	6.9'-7.5'	○	Silty gravelly coarse to fine sand			
1	3	10.0'-11.0'	△	Silty gravelly coarse to fine sand			
1	4	15.0'-16.0'	□	Silty gravelly coarse to fine sand			



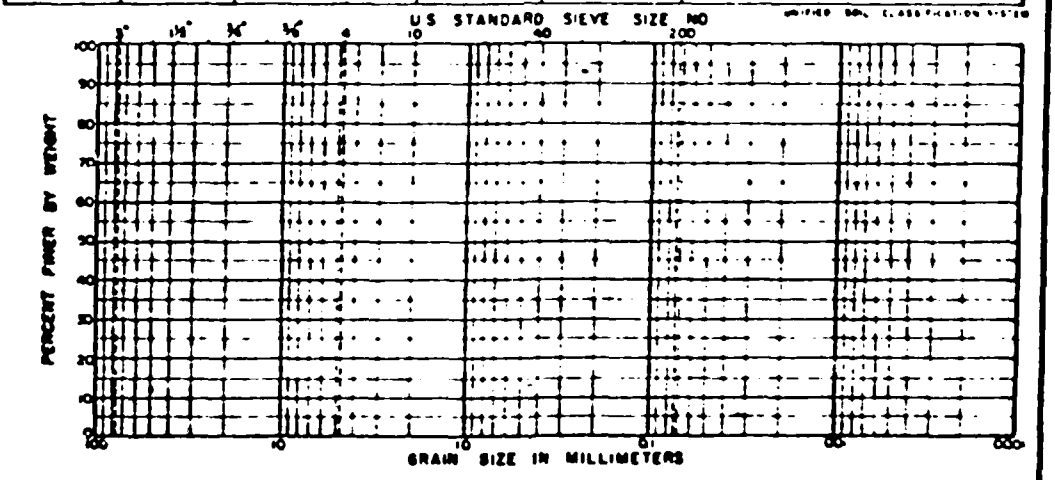
BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	WC	LL	PL
2	3	6.7'-7.5'	○	Silty gravelly coarse to fine sand			

PLATE 14

MECHANICAL ANALYSIS



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
TP-A	2	6'	○	Silty sandy gravel			
TP-C	7	3.0'-4.0'	△	Sandy gravel with trace silt			
TP-L-2		8'	□	Gravelly sandy slightly clayey silt	15	21	16



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL

PLATE 15

DESIGN REPORT

RECEIVED
AUG 16 '63
DEPT. CONS. & ECON. DEV.
WATER POLICY AND SUPPLY

N.J. - 625-R

Earthfill Dam
on Branch of Big Flat Brook

Linwood
Newark YM-YWCA Family and Senior Citizens Camp

Sandyston Township
Sussex County, New Jersey

Location

The site is on a branch of Big Flat Brook at a point approximately 2,300 ft. upstream from the U.S. Route 206 bridge across this stream. A site location map is shown on Page 2 of the drawings.

Hydrology

The drainage area upstream from the structure consists of 1.05 square miles of woodland and meadow. A study of the runoff producing characteristics of the watershed was conducted following methods outlined in SCS Engineering Handbook Section 4, Hydrology-Supplement A. This study consisted of a survey and analysis of the drainage area in which the following were considered: soil infiltration and permeability, land use, and vegetative cover. An estimate of the Time of Concentration was based on the topography of the watershed and physical characteristics of the stream channel. Rainfall data was obtained from U.S. Weather Bureau Technical Paper No. 40 and a six-hour Point Rainfall Map developed by the U. S. Soil Conservation Service, based on records of maximum rainfalls. It was estimated that a storm duration of approximately 6 hours would be most critical for this watershed. Hydrographs were prepared which reflect the net effect of the combination of factors determining the amount and time distribution of runoff from the watershed resulting from the design storms. Following is a summary of the hydrologic criteria on which the design of the structure is based:

1. A 25 yr.-6 hr. storm will pass through the Reinforced Concrete Drop Inlet Spillway (closed conduit spillway,) without any discharge through an Emergency Spillway. This design storm represents 4.1 inches of rainfall. Dwg 4A

2. The basis for the Emergency Spillway channel design is a 100 yr.-6 hr. rainfall. This represents 5.1 inches of rainfall. The frequency of use of the Emergency Spillway was estimated at once in 25 years. Dwg 4B

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE Box 670 New Brunswick, New Jersey	DRAWING NO. N.J. - 625-R SHEET 1 OF 3 DATE 8/16/63

3. The top of dam elevation was set so that a maximum 6-hr. point rainfall would pass through the spillway without overtopping the dam. This represents 10.2 inches of rainfall.

The storm hydrographs were routed to determine elevations of the emergency spillway crest (level section elevation.) design high water, and top of dam.

Hydraulics of Spillways

The principal spillway consists of a reinforced concrete drop inlet connected to a 54 inch diameter corrugated pipe. This type of spillway is also referred to as a closed conduit spillway. The pipe material will be 12 gage galvanized steel having an asbestos bonded bituminous coating. The stage discharge characteristics of the spillway were based on the results of model studies of similar structures at the St. Anthony Falls Hydraulic Laboratory, University of Minnesota, Minneapolis, Minnesota. This research is reported in Technical Paper No. 12, Series B, prepared by the U. S. Department of Agriculture, Agricultural Research Service, Soil and Water Conservation Research Division. A concrete slab on top of the concrete riser is necessary to prevent the formation of vortices, which would reduce the capacity of the spillway. The height of the slab above the riser crest was calculated (based on results of model studies) so that the anti-vortex device will have no other effect on the hydraulic characteristics of the spillway.

The Emergency Spillway is an open channel, trapezoidal in cross-section, having a bottom width of 120 feet and 2:1 side slopes. It will be excavated on the west side of the dam and will be a source of material for the earth fill embankments. The hydraulic design of the spillway is based on a method outlined in Technical Release No. 2, U. S. Soil Conservation Service. Essentially, the emergency spillway consists of an inlet channel, control section, and exit channel. Flow through the inlet channel is subcritical. At the control section the flow passes through critical depth, following which supercritical flow exists in the exit channel. The slope of the exit channel (below the control section) is set at greater than critical slope for all significant flows. Thus, supercritical flow is insured in the exit channel, and the stage-discharge relationship is determined at the assumed control section. The spillway was dimensioned so that the flow velocity would not exceed 4 feet per second for the design 100 yr.-6 hr. storm. This velocity could be tolerated for durations considerably in excess of those anticipated, with fair vegetative cover on the spillway.

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE Box 670 New Brunswick, New Jersey	DRAWING NO. N.J. - 625-R SHEET 2 OF 3 DATE 8/16/63

DESIGN REPORT

Subsurface Investigation and Embankment Design

The subsurface investigation was conducted jointly by the U. S. Soil Conservation Service and Woodward-Clyde-Sherard and Associates, Soil and Foundation Consulting Engineers, 1425 Broad Street, Clifton, New Jersey.

The embankment was designed by Woodward-Clyde-Sherard and Associates. Both of these subjects are reported by this firm under separate cover.

Design Summary

Factor Which Determines Stage	Rainfall Inches	Runoff Inches	Peak Inflow cfs	Maximum Stage Feet	Flood Storage Ac.Ft.	Element of Structure Determined by Max. Stage
Normal Pool	-	-	-	110.0	0	Crest of Riser
25 yr.-6 hr. Storm	4.10	1.60	590	112.7	31.1	Crest of Emergency Spillway
100 yr.-6 hr. Storm	5.10	2.36	815	113.5	42.7	Design High Water
6 hr. Point Rainfall	10.20	6.80	2460	115.9	78.0	Top of Dam

NOTE: Assumed elevation datum.

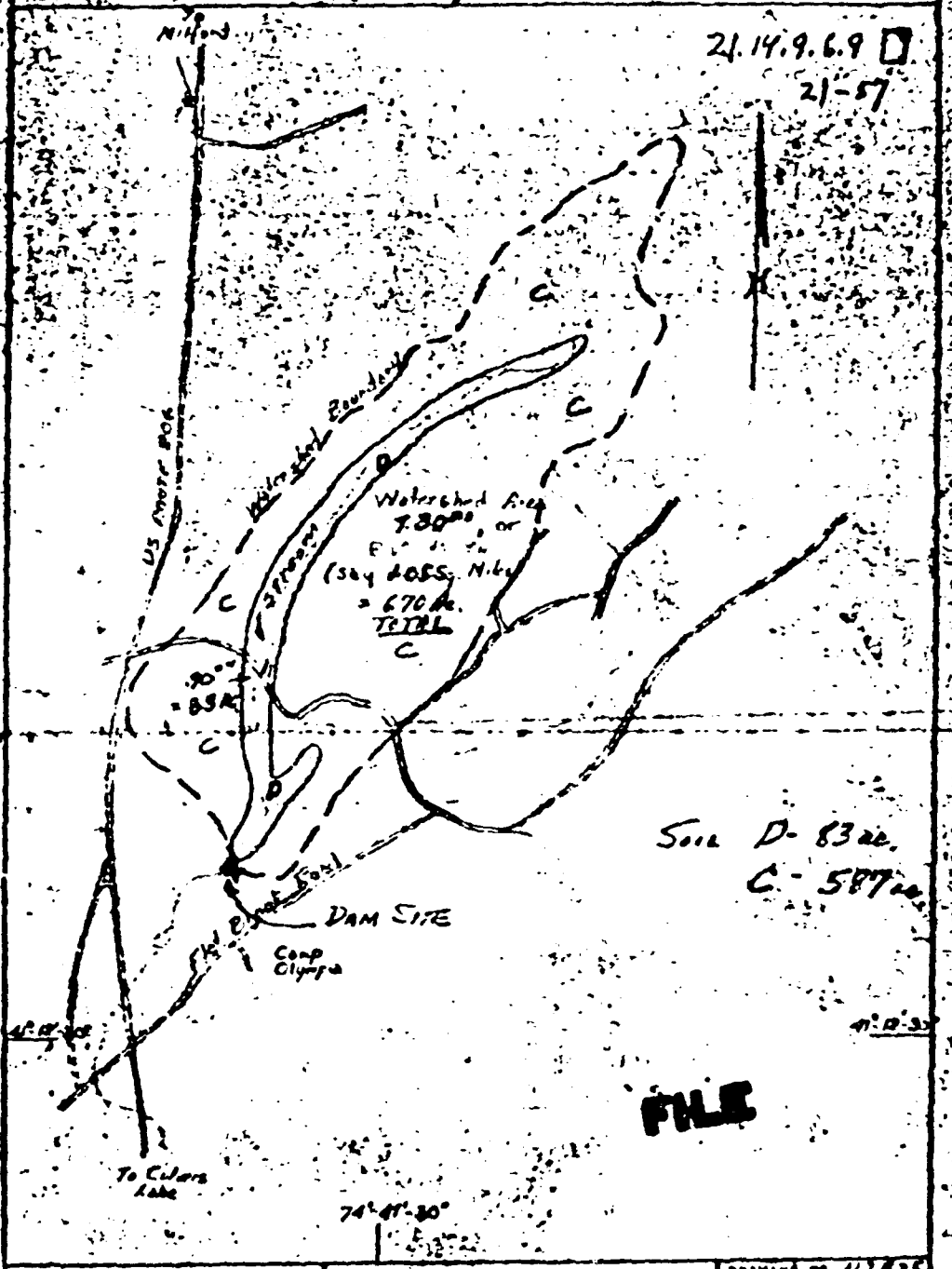
PREPARED BY: Robert H. Fox, P.E.
Robert H. Fox, PE
Design Engineer

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Box 670
New Brunswick, New Jersey

DRAWING NO.
N.J. - 625-R
SHEET 3 OF 3
DATE 8/16/63

WATERSHED MAP
NEWARK YMCA



REFERENCE: USDI GEOLOGICAL SURVEY 1:24000 CLIFFSIDE QUADRANGLE - NJ PENN

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ASSISTING
SUSSEX SOIL CONS. DISTRICT

DRAWING NO. NJ 825
NEWARK YMCA
CAMP
SHEET 1 OF 1
DATE 8-25-61

New Jersey YMCA Dam NJ 625
Dingmans Falls
Design Criteria Summary

1. Normal Pool Elev. = 1101'

2. Route 25yr. inflow hydrograph through Mach Spillway to establish crest stage of Emergency Spillway

3. Route 100yr. inflow hydrograph through Mach Spillway and Emerg. Spillway to establish stage Elev. for design high water

4. Route hydrograph developed from 100% of Point rainfall to establish the Min. elev. for the top of the dam.

[illegible]

1" = .1435 sq mi
1" = 91.827 ac

[illegible] YMCA-DAM [illegible] NJ [illegible] Sussex [illegible]

Drainage area _____ crest 1.05 [illegible] Class _____

Weighted Curve Number				
(1) Soil Group	(2) Complex (Land Use)	(3) Complex No.	(4) Acres	(5) (3) x (4)
C	Woods - Fair	73	587	42851
D	Woods - Fair	79	83	6557
			Sum	670 49408

Weighted Curve II $\frac{(5)}{(4)}$ = 73.7
Use: 73

670
83
587

Weighted Curve I
Weighted Curve III

Time of Concentration — T_c				
(1) Description of Course of Runoff Water	(2) Plane of Course (1)	(3) Length (1) of Course (ft)	(4) Velocity of Runoff Water (ft/sec)	(5) T_c (sec) (3) x (4)
OVERLAND NAT. DRAW-WOODS	7	3000	3	1000
CHANNEL	3	9000	6	1500
			Sum	2500

$T_c = \frac{2500}{3600}$ hr. = .0694

USE T_c = 0.7 hrs.

SCS-319A (3-67)

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

HYDROGRAPH COMPUTATION

Q_{25} : KHM 6-18-63

Checked RHM 6-19-63

WATERSHED OR PROJECT YMCA DAM STATE NJ

STRUCTURE SITE OR SUBAREA Sussex Co

DR. AREA 1.05 SQ. MI. T_c 0.7 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 73 STORM DISTRIB. CURVE B HYDROGRAPH FAMILY NO. 3

STORM DURATION 6 HR. RAINFALL P_{25} POINT 4.1 IN. AREAL 4.1 IN.

Q 1.6 IN. (0.7)(0.71) COMPUTED T_p 0.49 HR. T_p 4.2 HR.

$(T_p \div T_p)$ COMPUTED 8.6 USED 10 REVISED T_p 0.42

$q_p = \frac{484 A}{REV. T_p}$ = 1210 CFS Q_{q_p} = 1240 CFS

Dwg 4A

$q(COLUMN) = (t/T_p)$ REV. T_p $q(COLUMN) = q_p \cdot q_p \cdot Q_{q_p}$

LINE NO	t HOURS	q CFS	LINE NO	t HOURS	q CFS	LINE NO	t HOURS	q CFS
1	0	0	21	4.54	107	41		
2	0.23	2	22	4.76	58	42		
3	0.45	16	23	4.99	23	43		
4	0.68	134	24	5.22	12	44		
5	0.91	448	25	5.44	8	45		
6	1.13	588	26	5.67	4	46		
7	1.36	522	27	5.90	2	47		
8	1.57	433	28	6.12	0	48		
9	1.81	365	29			49		
10	2.04	307	30			50		
11	2.27	270	31			51		
12	2.50	237	32			52		
13	2.72	210	33			53		
14	2.95	188	34			54		
15	3.18	173	35			55		
16	3.40	157	36			56		
17	3.63	151	37			57		
18	3.8[illegible]	147	38			58		
19	4.0[illegible]	147	39			59		
20	4.31	146	40			60		

SCS-210-A (7-61) Use for Design high Water — U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

Emi Spry

HYDROGRAPH COMPUTATION

OK KWH 6-19-63

WATERSHED OR PROJECT YMCA - DAM STATE NJ 625

SPONSORED BY OR CITY SUSSEX Co.

DR. AREA 105 SQ. MI. t_c 0.7 HR. RUNOFF CONDITION NO. 2

RUNOFF CURVE NO. 73 STORM DISTRIB. CURVE B HYDROGRAPH FAILED NO. 3

STORM DURATION 6 HR. RAINFALL 100 yr. POINT 5.1 IN. AREA 5.1 IN.

Q 2.36 IN. COMPUTED T_p .49 HR. T_p .445 HR.

$T_c + T_p$ COMPUTED 7.08 USED 10 REVISED T_p .445

$q_u = \frac{484\,A}{REV\ T_p}$ = 1142 CFS q_u = 2695 CFS Dwg 4C

(COLUMN) = (R/T$_p$) REV T_p (COLUMN) = (q/q$_u$)

LINE NO.	I HOURS	q CFS	LINE NO	I HOURS	q CFS	LINE NO.	I HOURS	q CFS
1	0.00	0	21	4.926	148	41		
2	0.240	3	22	5.046	51	42		
3	2431	22	23	5.287	32	43		
4	2.771	136	24	5.527	16	44		
5	6.961	123	25	5.767	11	45		
6	12.02	87	26	6.005	5	46		
7	1492	72	27	6.248	3	47		
8	1612	60	28	6.488	0	48		
9	1.922	207	29			49		
10	2.163	420	30			50		
11	2.403	81	31			51		
12	2.643	329	32			52		
13	2.884	191	33			53		
14	3.124	126	34			54		
15	3.364	140	35			55		
16	3.605	111	36			56		
17	3.845	70	37			57		
18	4.085	80	38			58		
19	4.325	216	39			59		
20	4.566	201	40			60		

SCS-210-A (3-67)

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

HYDROGRAPH COMPUTATION

Free Land Graph
1-Hr Rain Fall

WATERSHED OR PROJECT YMCA DAM STATE NJ 25

STRUCTURE SITE OR SUBAREA

DR. AREA 1.05 SQ. MI. t 0.7 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 73 STORM DISTR. CURVE B HYDROGRAPH FAMILY NO. 2

STORM DURATION 6 HR. RAINFALL (1-0) Point POINT 10.2 IN. AREA 10.2 IN.

Q 6.8 IN. COMPUTED t 0.49 HR. t 5.05 HR.

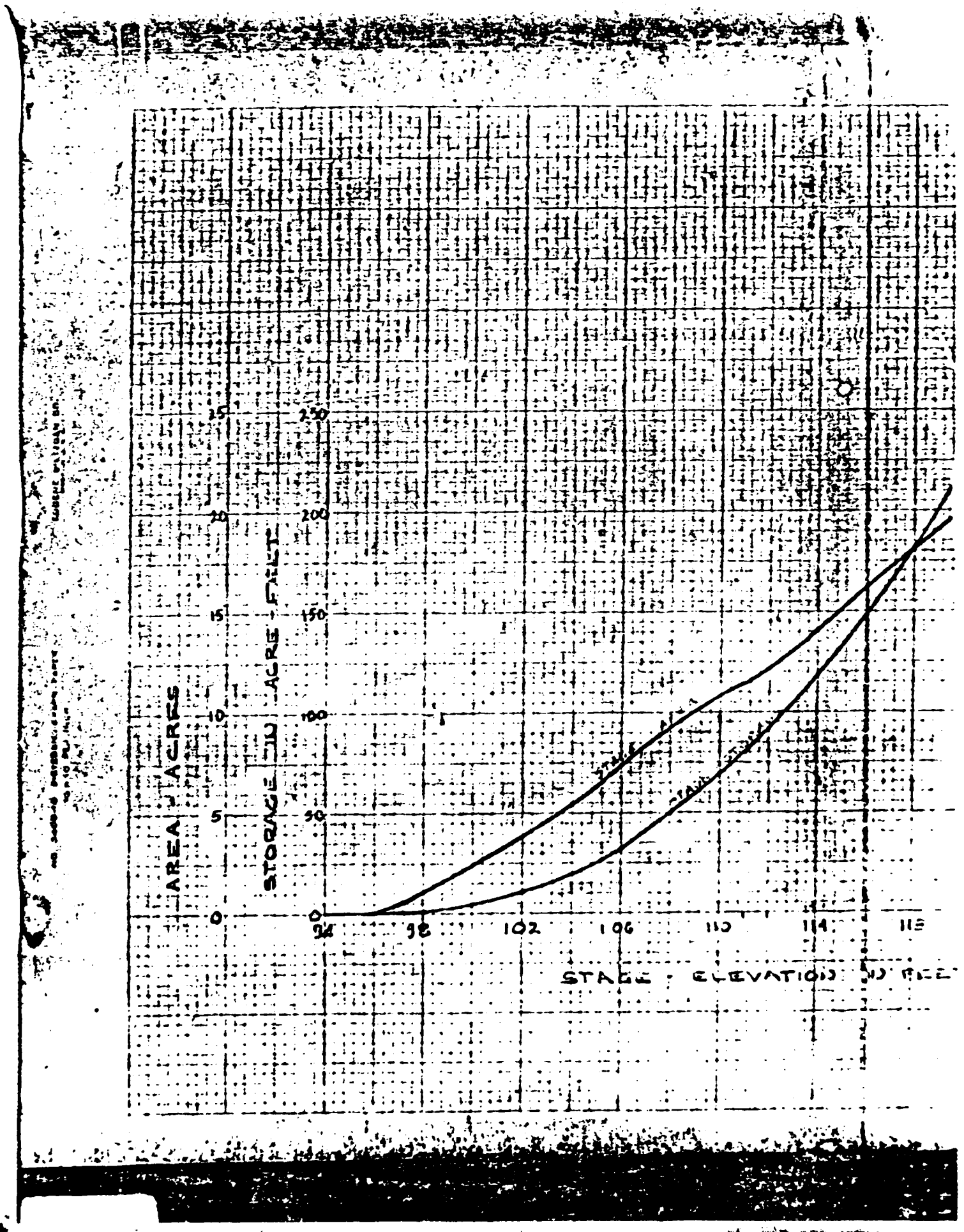
(T+Tc) COMPUTED 8.81 USED 10 REVISED T 0.51

$q_p = \frac{484\,A}{REV.\ T_p} = 996$ CFS $Q_m = 6770$ CFS

(COLUMN) = R, T,) REV. T_p (COLUMN) - (a) = Q_m

P 1 F 47

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0	0	21	6.13	27	41		
2	0.32	14	22	6.15	14	42		
3	0.64	61	23	7.07	7	43		
4	0.96	183	24	7.39	0	44		
5	1.29	427	25			45		
6	1.61	1518	26			46		
7	1.93	2964	27			47		
8	2.25	2018	28			48		
9	2.57	1530	29			49		
10	2.89	1164	30			50		
11	3.21	921	31			51		
12	3.53	765	32			52		
13	3.86	657	33			53		
14	4.18	576	34			54		
15	4.50	528	35			55		
16	4.82	501	36			56		
17	5.14	467	37			57		
18	5.46	359	38			58		
19	5.78	161	39			59		
20	6.10	31	40			60		


AREA - ACRES
STORAGE - ACRE - FEET
0
5
10
15
20
25
50
100
150
200
250
98
102
106
110
114
118
STAGE - ELEVATION - FEET

SHEET ___ OF ___

N J 625
A A JUNKINS 1-63

118 122

FEET

AVAILABLE STORAGE
STAGE STORAGE 4
STAGE AREA CURVES
NEWARK YMCA CAMP
SUSSEX COUNTY, NEW JERSEY

SCS 344 5 67
Tabular Computations

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Sheet of

Newark YMCA Dam NJ 625

Sussex County, N.J. 3-25-63

Weir Flow - Discharge Curve Comp. JLA

L_w = 22 ft C = 3.4 CL = 74.8

Elev		H_w (ft)		$H^{3/2}$		Q_w		
110.0		0.0		0.00		0.00		
110.2		0.2		0.059		6.69		
110.5		0.5		0.354		26.48		
110.7		0.7		0.586		43.83		
111.0		1.0		1.000		74.50		
111.5		1.5		1.837		137.41		
112.0		2.0		2.828		211.53		
112.5		2.5		3.953		295.69		
113.0		3.0		5.196		388.66		
113.5		3.5		6.549		489.79		
14.0		4.0		8.0[illegible]		598.40		

SCS-344 8-57
Tabular Computations

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Sheet of

Newark YMCA Dam NJ 625

Sussex County, N.J. 3-25-63

Pipe Discharge - Discharge Curve Comp. JLA

$K_r = 0.0156$
$n = 0.025$
$C_p = 63.8$ (54" CMP)

$C_p = \sqrt{\frac{2g A_p^2}{1 + K_r + \frac{K_r L}{R} + \left(K_r L_r \left(\frac{A_p}{A_r}\right)^2\right)}}$ (Neglect)

$Q_p = C_p H^{1/2}$

Elev		Head H_p		$H_p^{1/2}$		Q_p		
111.0		15.2		3.90		249.82		
111.5		15.7		3.96		252.65		
112.0		16.2		4.03		257.11		
112.5		16.7		4.09		260.94		
113.0		17.2		4.15		264.77		
113.5		17.7		4.21		[illegible]		
114.0		18.2		4.27		272.45		
114.5		18.7		4.33		276.25		
115.0		19.2		4.39		[illegible]		
115.9		20.1						
116.0		20.2						
117.0		21.2						

SCS 344 8 67
Tabular Computations

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET OF

AREA OF CONTOURS FOR STA [illegible]-STORAGE AREA CURVES NJ 625

NEWARK UNION CAMP - SUSSEX COUNTY, NJ

1-63

10" = 3600' = 0.0826 AC

STAGE (FT).	PLANIMETER READING (1) (IN²)	(2) (IN²)	(3) (IN²)	AVG READING (IN²)	AREA (ACRES)	INC AREA ACRES	VOLUME (AC-FT)	CUM VOLUME (AC-FT)
94.5	0	0	0	0	0			0
						0.[illegible]5	0.00[illegible]	
95	.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	0.[illegible]			0.[illegible]03
						0.45	0.045	
96	1.[illegible]	1.[illegible]	1.[illegible]	1.[illegible]3	0.[illegible]8			0.[illegible]48
						0.[illegible]5[illegible]	0.[illegible]55	
97	5.[illegible]	5.[illegible]	5.[illegible]	[illegible]	0.43			0.[illegible]3
						0.72[illegible]	0.12[illegible]	
98	12.2[illegible]	12.[illegible]	12.[illegible]1	12.[illegible]1	1.0[illegible]			1.[illegible]
						1.[illegible]0	2.3[illegible]	
100	23.1[illegible]	23.[illegible]	23.[illegible]	23.[illegible]7	2.327			4.[illegible]
						3.[illegible]	6.0[illegible]	
102	45.[illegible]	45.[illegible]	45.[illegible]7	45.[illegible]	3.772			10.45[illegible]
						4.[illegible]9	7.1[illegible]7	
104	64.[illegible]2	64.[illegible]	64.[illegible]6	64.33	5.[illegible]5			17.6[illegible]
						[illegible]	12.[illegible]2	
106	85.[illegible]2	85.[illegible]2	85.[illegible]6	85.[illegible]7	7.3[illegible]7			32.26[illegible]
						[illegible]	[illegible]	
108	112.77	112.[illegible]	112.[illegible]	112.56	3.[illegible]			45.[illegible]7
						1.237	2.[illegible]5	
110	132.[illegible]	132.[illegible]	132.[illegible]	132.[illegible]6	11.75[illegible]			68.[illegible]2
						11.45[illegible]	22.[illegible]	
112	147.96	147.[illegible]	147.[illegible]	147.[illegible]7	12.[illegible]			91.[illegible]
						13.[illegible]	2.[illegible]30	
	172.[illegible]	172.[illegible]	[illegible]91	172.[illegible]1	17.[illegible]			[illegible]
						[illegible]	3.[illegible]	
114	196.[illegible]1	196.[illegible]	196.[illegible]	196.71	16.[illegible]			[illegible]

SCS 344 5 57
Tabular Computations

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

(CONT)
SHEET ___ OF ___

AREA OF CONTOURS FOR STAGE-STORAGE AND AREA CURVES

NEWARK YMCA CAMP

AA JUMIKIS 1-63

NJ 625

STAGE (FT)	PLANIMETER READINGS ① (IN²)	② (IN²)	③ (IN²)	AVE READING (IN²)	AREA (ACRES)	AVE AREA (ACRES)	VOLUME (AC-FT)	ΣV. VOLUME (AC-FT)
116	136.71	136.66	136.77	136.71	16.248			148.463
						17.206	34.416	
118	219.52	220.16	220.15	219.95	18.165			182.885
						13.146	38.292	
120	243.42	243.63	242.79	243.63	20.124			221.177

SCS 344 5-67
Tabular Computations

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Sheet of

Newark YMCA Dam NJ 625

Sussex County, N.J. 3-26-63

STAGE STORAGE COMPUTATION: JLA

Elev.	Storage							
110.0	0.0							
111.0	11.5							
112.0	22.9							
113.0	36.0							
114.0	49.2							
115.0	63.5							
116.0	7[illegible]							
117.0	97.5							
118.0	113.9							

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SCS-347 5-57
Tabular Computations

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Newcastle YMCA Dam Emergency Spillway

Excavated Earth Plane of Approach

Q_u (cfs/ft)	H_p (ft)	Stage (ft)	d_c (ft)	$Z\,d_c$ (ft)	$W = b + Z d_c$ (ft)	$Q_{unit} = Q \cdot W$	C_v	$Q = Q_{unit} \cdot C_v$			
0	0	113.2	0	0	120	0	266	0	0		
0.4	0.43	113.63	0.11	0.22	120.3	48.1	269	12.9	8.5		
1	0.64	113.84	0.19	0.38	120.6	122.6	270	33.1	3.8		
2	0.93	114.13	0.30	1.00	121.0	242.1	272	65.8	3.7		
3	1.23	114.43	0.40	1.22	121.3	363.9	275	100.1	3.6		
4	1.49	114.69	2.19	1.54	121.6	484.8	278	134.8	3.6		
5	1.73	114.93	0.91	1.82	121.9	609.0	280	170.5	5.87		
10	2.61	115.82	1.22	2.91	122.9	1222.1	288	352.0	6.82		
15	3.22	116.43	1.41	3.52	123.6	1848.0	294	543.0	7.72		
20	3.74	117.19	2.52	4.98	124.9	2497.0	299	746.9	8.15		
	3				123						
		115.2									
						48.1		312.1			

SCS-347 5-57
Tabular Computations

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Newcastle YMCA Dam Emergency Spillway

Freeway Drive Dam Rate of Discharge

Q (cfs/ft)	H_p (ft)	Stage (ft)	d_c (ft)	Z dc (ft)	W = b + Z dc (ft)	Q_{max} = Q·W	Q_v (cfs)	Q = Q_{max} − Q_v			
0	0	113.2	0	0	120	0	266	266	0		
0.1	0.43	113.63	0.11	0.22	120.3	421	269	152	4.5		
1	2.64	115.84	0.95	0.63	120.6	1356	270	1086	3.8		
2	3.79	116.99	0.99	1.00	121.0	2421	272	2149	4.2		
3	4.23	117.43	0.96	1.22	121.3	3654	275	3379	4.9		
4	4.69	117.89	2.19	1.51	121.6	4926	278	4648	5.0		
5	4.93	118.13	0.96	1.93	121.9	6099	282	5817	5.47		
10	6.61	119.81	1.82	2.31	122.9	12333	288	12045	6.72		
15	7.68	120.88	1.91	2.82	123.6	18948	294	18654	7.42		
20	8.54	121.74	2.12	2.96	124.0	25496	299	25197	7.98		
	9				123						
		113.2									
						4831		3212			
		1									

TURE

N 625

Used paper

U. S. GOVERNMENT PRINTING OFFICE

8/21/61

Dam 569

Embankment Stability

1. Core and foundation material
Plastic, clayey material

Cohesion, c = 100 psf
ϕ = 25°
(estimated) γ = 130 lb/ft³ saturated
γ = 90 lb/ft³ dry

2. Random Material
Cohesionless, c = 0
ϕ = 30°
(estimated) γ = 140 lb/ft³ saturated
γ = 110 lb/ft³ dry

For solution, see Graphical Analysis

Circle arc length = $\frac{37}{360} \times 326.73 = 179$ ft.

N-Forces

Random Mat. 302 sq ft × 140 = 42400
30 " × 110 = 3310
Core Mat. 491 " × 130 = 63800
63 " × 90 = 5670

Σ N-Forces = 113870 lbs

8/21/13

Stability, continued

T - Forces

Negative: Random Mat'l 15 sq ft x 140 = 2100
Core Mat'l = 45 " x 130 = 5850
Total Neg. T-Forces = 7950 lbs

Positive Random Mat'l = 58.5 x 140 = 8200
15 x 110 = 1650
Core Mat'l = 129 x 130 = 16760
63 x 90 = 5670
Total Neg T-Forces = 32,280

Σ T Forces = 32280 − 7950 = 24,330

Tan θ = Tan 25° = 0.4663

Cohesion = Lc = 179 x 100 = 17900

$$F.S. = \frac{\Sigma N \tan\phi + Lc}{\Sigma T} = \frac{113870 \times 0.47 + 17900}{24330}$$

(53600)

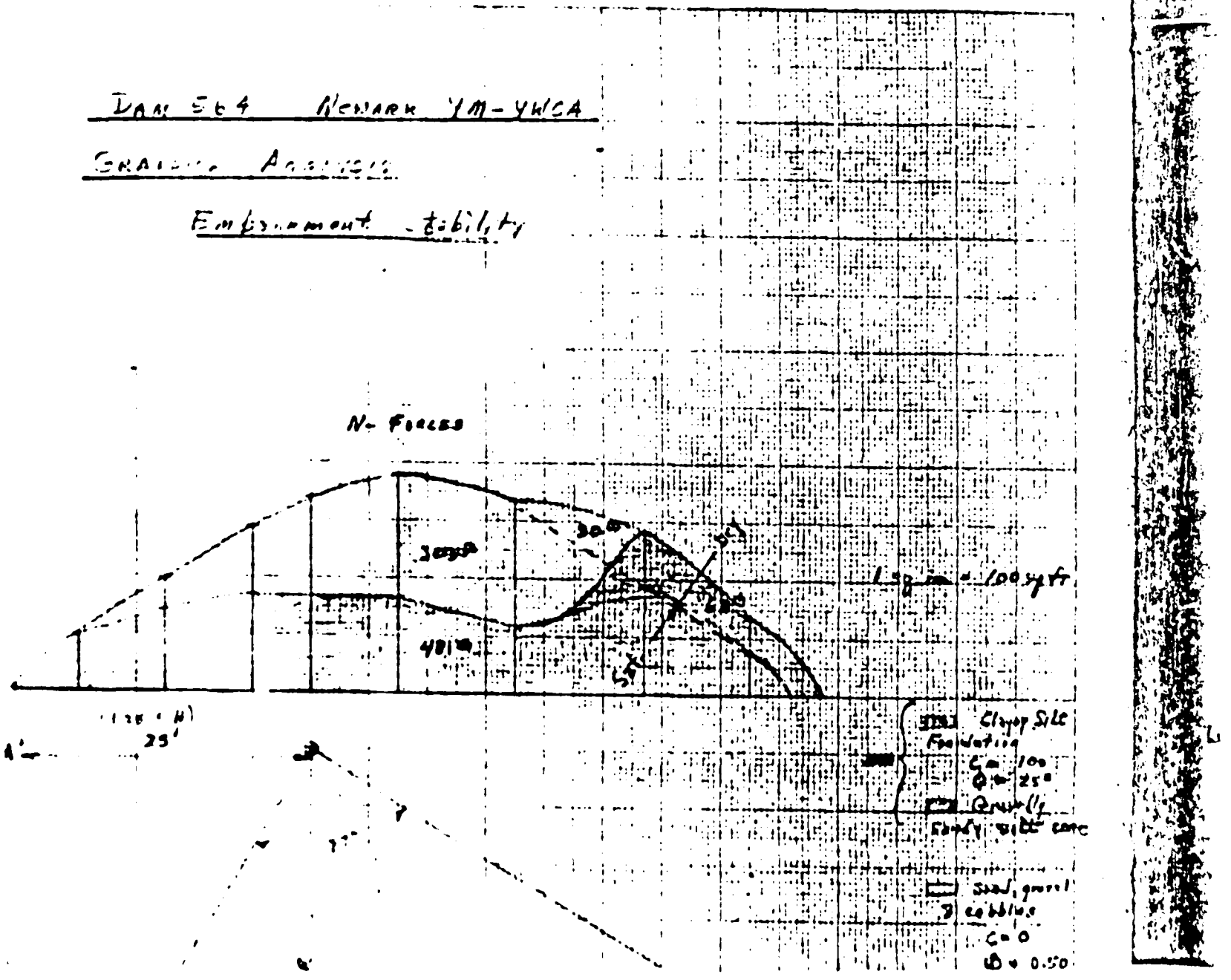
$$F.S. = \frac{71400}{24330} = 2.93$$

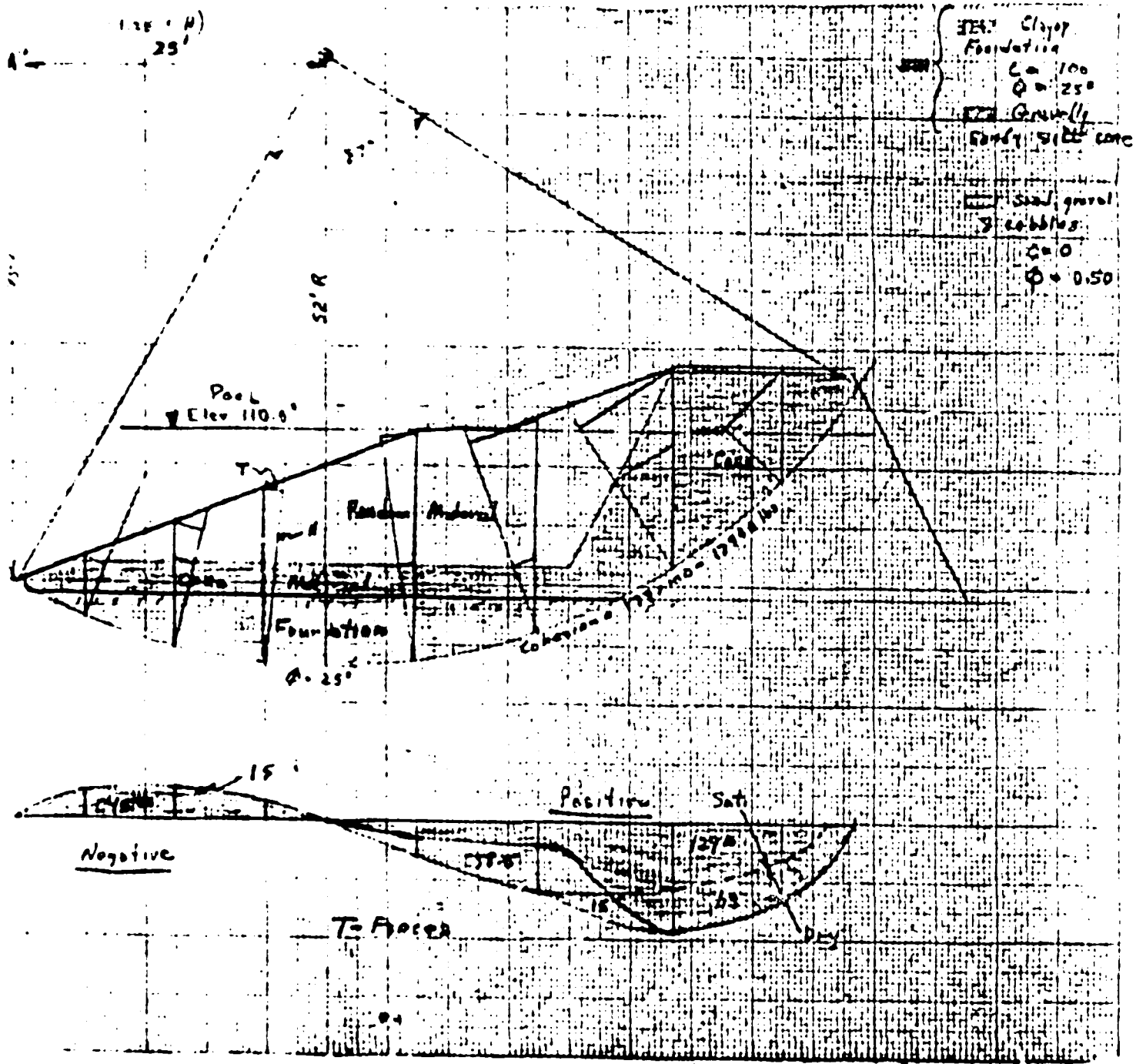
OK.

DAM 564 NEWARK YM-YWCA

GRAPHIC ANALYSIS

Embankment stability





Clayey Foundation
C = 100
Φ = 25°
Gravelly
Sandy silt core
Sand, gravel & cobbles
C = 0
Φ = 0.50
25'
52' R
Pool
Elev 110.0'
Random Material
Foundation
Φ = 25°
Core
15
Positive
Sat
Negative
129
Dry
T = Proceed

Report on Dam Inspection

NEWARK YMCA DAM
DAM APPLICATION NO. 564

Inspection was made of the subject dam site in company with Victor Elias, on October 2, 1963. Inspection disclosed that the lake site has been partially cleared and the site of the dam has been stripped to a layer of heavy sand clay except in two small areas, one of which was composed of heavy organic clay which appeared to be satisfactory, and the other section was composed of organic muck. Mr. Elias advised that more of the organic clay would be removed, but rather than go down completely to try and find better material and take the chance of completely stripping the clay blanket which is only approximately 3 feet thick and overlays a strata of sand and gravel, he felt it would be better to use the organic clay. He advised that the muck would be removed entirely and if necessary a clay blanket would be constructed in this area. A clay blanket will also be constructed in this area for a short distance upstream and downstream of the dam. A core wall is to be constructed into the existing earth embankment at the easterly end of the dam, since material here is not as what was expected. The emergency spillway section has been completely cleared but has not been graded. The work appeared to be progressing in a satisfactory manner.

John H. O'Dowd, P. E.
Supervising Engineer

Trenton, New Jersey
October 2, 1963

JOD:ax

OAKLAND CALIFORNIA
SAN DIEGO CALIFORNIA

DENVER COLORADO
KANSAS CITY MISSOURI
PHILADELPHIA PENNSYLVANIA

OMAHA NEBRASKA
NEW YORK NEW YORK

WOODWARD-CLYDE-SHERARD AND ASSOCIATES
SOIL AND FOUNDATION ENGINEERING
425 BROAD STREET
CLIFTON, NEW JERSEY
TELEPHONE 471-2000

PRINCIPALS
JAMES L. SHERARD
DOUGLAS C. MOORHOUSE
DAVID M. SHEED

ASSOCIATE
ROY E. HUNT

July 14, 1964
63M183

RECEIVED
JUL 12 '67
DEPT. CONS. & ECON. DEV.
DIVISION OF
WATER POLICY AND

Newark YM-YWCA
600 Broad Street
Newark 2, New Jersey

Attention: Mr. Louis Briegel

Final Report
Construction Inspection
Newark Y.M.C.A Dam
Sandyston Township, New Jersey

Gentlemen:

Submitted herewith is our report describing the final phase of construction at the subject project. After the winter shut-down, work was resumed at the site on May 4, 1964, and was completed on June 10, 1964.

Our inspection indicates that the embankment was constructed to final design grades and in accordance with the specifications. Field density tests were taken periodically in the core section of the embankment to insure that the required compaction was attained. These tests are tabulated as follows:

Test #	Location	Per cent Moisture	Unit Dry Weight pcf	Per cent of Compaction
6	Sta. 1+50 El. 103	11.4	120	99
7	Sta. 2+00 El. 105	11.2	119	98
8	Sta. 2+50 El. 107	10.5	119	98
9	Sta. 4+00 El. 108	10.0	120	99
10	Sta. 4+50 El. 109	9.0	127	100+
11	Sta. 5+00 El. 111	12.5	115	96

Gradation curves for most of the above test samples are shown on the attached plate.

Earlier field density test results were presented in our interim report dated December 18, 1963.

Other phases of the project which were completed or carried out satisfactorily during this period included: completion of the drop-inlet spillway riser; final grading of the emergency spillway; grading of the main borrow area and spreading of topsoil over this area; and construction of 2:1 slopes around the upper end of the lake between Elev. 107 and 110. In addition, a layer of impervious core-type material about one-foot thick was placed over exposed gravelly areas at about Elev. 107 in the upper end of the lake, in accordance with our recommendations.

We have enjoyed working with you on this project. Please call us if we can be of further service.

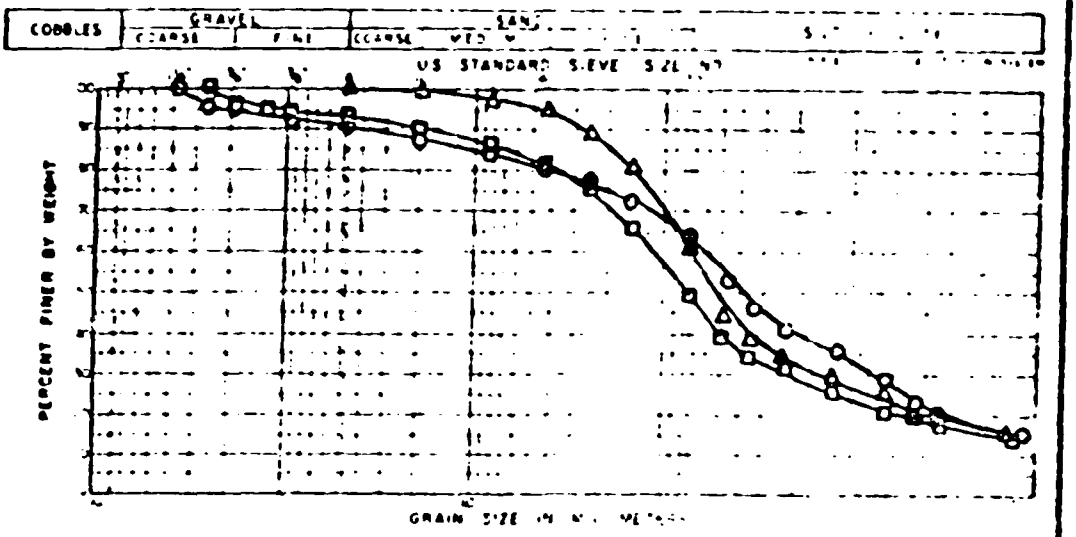
Very truly yours,

Herbert L. Lobdell, P. E.

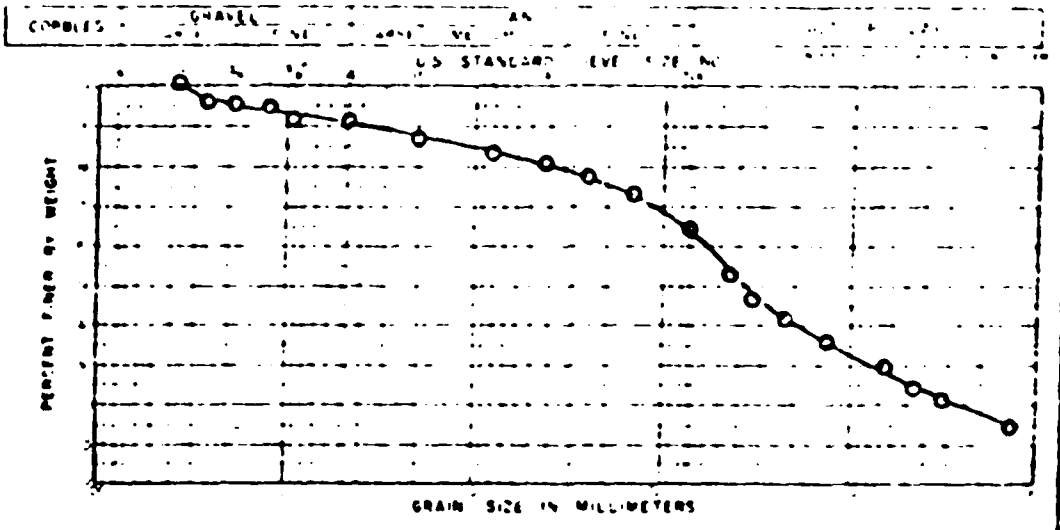
David M. Greer, P. E.

HLL:sd
Submitted: 5 copies

GRAIN-SIZE DISTRIBUTION



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION
	8	Type #1	○	Slightly gravelly sandy clayey silt
	9	Type #1	△	Sandy clayey silt
	10	Type #1	□	Slightly gravelly sandy clayey silt



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION
	11	Type #1	○	Slightly gravelly sandy clayey silt

PLATE

of Newark and Vicinity
600 Broad Street,
Newark, N.J.
MA 4-8900

YMCA

Camping Services

CAMP DAWSON
boys and girls day camp

KAMP KIAMESHA
boys resident camp

LINWOOD
retreat center
for families and senior citizens

CAMP MACDONALD
girls resident camp

RECEIVED
JAN 12 '67
DIVISION OF
WATER POLICY AND SUPPLY

January 11, 1967

Mr. George R. Shanklin
Chief, Engineer and Director
Division of Water Policy and Supply
Department of Conservation and Economic Development
P.O. Box 1390
Trenton
New Jersey 08625

Re: Dam Application #564

Dear Mr. Shanklin:

When I talked with you on the phone yesterday I'm sure you realized that your letter of January 9, 1967 was quite a shocker.

We now find that your letter of July 20, 1966 was received by Louis R. Briegel, our Camping Services Director who forwarded it to Woodward-Clyde-Sherard and Associates, Clifton, New Jersey. We assumed that a copy of the final report of the engineers had been sent to you.

Enclosed you will find a copy of this Final Report, Construction Inspection dated July 14, 1964 signed by the resident and supervising engineers,

I can personally certify that from personal visits before, during and after construction that construction was carried out in line with specifications. I can further certify that a licensed engineer was in residence during the entire working hours to run moisture and compaction tests and laying and knitting of each 4 inches of clay.

If the information which we have enclosed is not sufficient we will be pleased to comply with your requests.

Incidently, members of the United States Department of Agriculture Soil Conservation Service, Trenton, New Jersey were very much interested with the project from the initial steps and followed the work to completion. They were extremely well pleased. The principals involved were Richard H. Marston and Robert H. Fox.

Sincerely yours,

Joseph H. Partenheimer
Vice President
YM-YWCA of Newark and Vicinity

P. S. Enclosed you will find a dedication folder naming the lake "Lake Robert Rooke". We would appreciate your naming it as such on all official maps.

JHP:mr
Encls.

APPENDIX 2

CHECK LIST - HYDROLOGIC AND HYDRAULIC DATA

CHECK LIST - VISUAL INSPECTION

CHECK LIST - ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.05 sq. mi., Wood & Forest Land

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 110.0 (69 ac ft)

ELEVATION TOP OF DAM (STORAGE CAPACITY): 115.9 (147 ac ft) Assumes top of Dam

ELEVATION EMERGENCY SPILLWAY CREST 112.7

ELEVATION TOP DAM: 115.9

CREST: Drop inlet Spillway (Principal Spillway)

a. Elevation 110.0
b. Type Drop inlet spillway, 4 1/2 x 6 1/2 ft riser to 54 in. dia CMP discharge pipe
c. Width NA
d. Length NA
e. Location Spillover Approx 170 ft left of right dam abutment
f. Number and Type of Gates None

OUTLET WORKS:

a. Type 16 in dia. CIP low level outlet discharging into spillway riser
b. Location in drop inlet spillway
c. Entrance inverts 97.0
d. Exit inverts El 97.0 into spillway riser, El 93.0 at spillway discharge
e. Emergency draindown facilities Same

HYDROMETEOROLOGICAL GAGES: None
a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 2093 cfs at top of dam

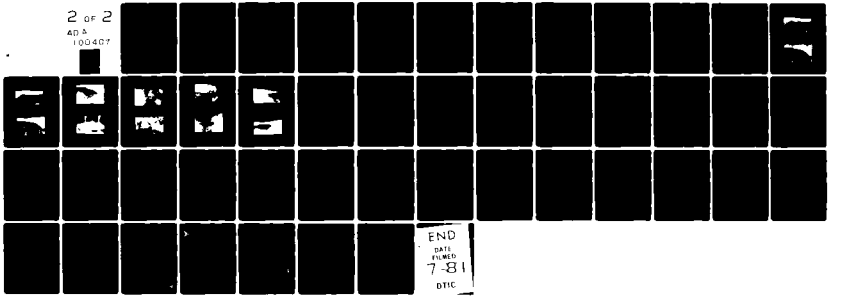
Emergency Spillway:

Type:	Earth, broad crested weir
Crest Elevation:	112.7
Width:	120 ft
Crest Length:	20 ft
Location:	Approx 100 ft west of right dam abutment.

AD-A100 407 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/13
NATIONAL DAM SAFETY PROGRAM. LAKE ROBERT ROOKE DAM (NJ00262), D--ETC(U)
MAR 81 P K YU DACW61-79-C-0011

UNCLASSIFIED DAEN/NAP-53842/NJ00262-81/ NL

2 OF 2
AD A
100407



END
DATE FILMED
7-81
DTIC

Check List
Visual Inspection
Phase 1

Name Dam Lake Robert Rooke Dam County Sussex State NJ Coordinators NJ DEP

Date(s) Inspection 9/26/80 12/11/80 Weather Clear Temperature Mid 70's° F

Pool Elevation at Time of Inspection 109.4± Arbitrary Datum MSL. Tailwater at Time of Inspection 93.7 Arbitrary Datum MSL.

Inspection Personnel:

R. W. Greene P. Yu D. Leary

V. Urban

R. W. Greene Recorder

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE OBSERVED.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE OBSERVED.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	MINOR EROSION OF EMBANKMENTS CAUSED BY NUMEROUS FOOTPATHS. EROSION ALONG UPSTREAM EMBANKMENT AT POOL ELEVATION.	REPAIR AREAS OF EROSION.
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	NO APPARENT DEFICIENCY OBSERVED.	
RIPRAP FAILURES	NO RIPRAP OBSERVED.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
	EMBANKMENTS BECOMING OVERGROWN WITH BRUSH AND TREES.	REMOVE TREES, PROVIDE FILTER COVERAGE ON DOWNSTREAM FACE TO PREVENT ANY SEEPAGE RESULTING FROM FUTURE ROOT DECAY.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	NO APPARENT DEFICIENCY OBSERVED.	
ANY NOTICEABLE SEEPAGE	NONE APPARENTLY OBSERVED, LOCALIZED SPONGY GROUND AT DOWNSTREAM TOE NEAR CENTER LINE OF DAM.	FURTHER INVESTIGATE CONDITION.
STAFF GAGE AND RECORDER	NONE OBSERVED.	
DRAINS	NONE VISIBLE.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	NO APPARENT DEFICIENCY OBSERVED.	OUTLET CONDUIT IS A 54 IN DIA CMP.
INTAKE STRUCTURE	CONCRETE DROP INLET HAS ACCUMULATION OF BRANCHES AROUND TOP OF INLET. THE RISER HAS NUMEROUS BRANCHES IN IT. NO DEFICIENCY OBSERVED ON CONCRETE.	REMOVE BRANCHES FROM RISER AND INLET. INSTALL TRASH SCREENS TO PREVENT REOCCURANCE.
OUTLET STRUCTURE	NO APPARENT DEFICIENCY OBSERVED.	
OUTLET CHANNEL	WIDE STREAMBED WITH GRASS & BRUSH. SMALL COBBLE DAM APPROX 1 FT HIGH ACROSS STREAMBED.	REMOVE COBBLE DAM.
EMERGENCY GATE	16 IN DIA CI LOW LEVEL OUTLET WITH SLIDE GATE IN UPSTREAM SIDE OF DROP INLET RISER. APPROX. 12 FT BELOW TOP OF INLET. SLIDE GATE LEAKING WATER.	REPAIR SLIDE GATE

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	ROUGLY 4H:1V TREES & BRUSH COVERED.	
SEDIMENTATION	VERY LITTLE OBSERVED.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	WIDE STREAM BED WITH SMALL COBBLE DAM APPROX 1 FT HIGH ACROSS STREAMBED ABOUT 30 FT DOWNSTREAM OF 54" CMP OUTLET. THICK TREES & BRUSH ALONG STREAMBED. NO RIPRAP OBSERVED AT 54" CMP DISCHARGE.	REMOVE COBBLE DAM. CLEAR CHANNEL.
SLOPES	GENTLE, DENSELY VEGETATED WITH TREES AND BRUSH.	
APPROXIMATE NO. OF HOMES AND POPULATION	NONE OBSERVED.	

CHECK LIST
-ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS		
PLAN OF DAM	DAMSITE & LAKE AREA NEWARK YMCA DAM SANDYSTON TOWNSHIP SUSSEX CO., NEW JERSEY	PREPARED BY: US DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE DRAWING NO. NJ 625-P, SHEET 2 OF 4, 1963	
REGIONAL VICINITY MAP	SEE FIGURE 1		
CONSTRUCTION HISTORY	NO INFORMATION AVAILABLE		
TYPICAL SECTIONS OF DAM	EMBANKMENT PLANS & PROFILE NEWARK YMCA DAM SANDYSTON TOWNSHIP SUSSEX COUNTY, NEW JERSEY	PREPARED BY: US DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE DRAWING NJ 625-P, SHEET 3 OF 4, 1963	
HYDROLOGIC/HYDRAULIC DATA	LETTER FROM: US DEPT OF AGRICULTURE, SOIL CONSERVATION SERVICE, BOX 670 NEW BRUNSWICK, N.J. MR. RICHARD H. MARSTON DATED June 27, 1963 Source: NJ DEP Application 564	MEMORANDUM TO: ROBERT L. HARDMAN, CHIEF, BUREAU OF WATER CONTROL FROM RAYMOND A. WEBSTER, DATE June 28, 1963, Source: NJ DEP Application 564	DESIGN REPORT NJ625- BY US DEPT OF AGRIC. SOIL CONSERVATION SERVICE, BOX 670 NEW BRUNSWICK, NJ 8/16/63
OUTLETS - PLAN			
- DETAILS	STRUCTURE & STEEL DETAIL NEWARK YMCA DAM SANDYSTON TOWNSHIP SUSSEX COUNTY, NEW JERSEY	PREPARED BY: US DEPT OF AGRIC. SOIL CONSERVATION SERVICE DRAWING NO NJ 625-P, SHEETS 3 OF 4, 4 OF 4, 1963	
~~-CONSTRAINTS~~			
~~-DISCHARGE RATINGS~~			
RAINFALL/RESERVOIR RECORDS	NO INFORMATION AVAILABLE		

ITEM	REMARKS	
DESIGN REPORTS	Subsurface Investigation and embankment design by Woodward-Clyde - Sherard Associates 1425 Broad Street, Clifton, New Jersey "Preliminary Report, Soil and Foundation Investigation and Design Newark YMCA Dam, Sandston Township, New Jersey" June 18, 1963	Source: NJ DEP Application No. 564
GEOLOGY REPORTS	See Design Reports	
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Design Report NJ 625-R US Department of Agriculture Soil Conservation Service Box 760 New Brunswick, NJ Dated 8/16/80	Source: NJ DEP Application NO. 564
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	See Design Reports	
POST-CONSTRUCTION SURVEYS OF DAM	Report by: Woodward Clyde Sherard & Associates 1425 Broad Street, Clifton, New Jers Final Report, Construction Inspection Newark YMCA Dam, Sandyston Township, New Jersey dated July 14, 1964	
BORROW SOURCES.	Indicated on Plan, Damsite & Lake Area, Newark YMCA Dam Sandyston Township, Sussex County New Jersey And Preliminary Report given under Design Reports	Prepared by: US Department of Agriculture Soil Conservation Service Drawing NO. NJ 625-P Sheet 2 of 4, 1963 Source: NJ DEP Application 564

ITEM	REMARKS
MONITORING SYSTEMS	NONE OBSERVED
MODIFICATIONS	NONE OBSERVED
HIGH POOL RECORDS	NO INFORMATION AVAILABLE
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Report By: Woodward-Clyde-Sherard & Associates July 18, 1967 Arnold R. Smith, NJ PE 14857, November 11, 1968 Charles H. Thanley, NJ PE 15594, September 4, 1970 Charles H. Thanley, NJ PE 15594, August 28, 1971 Source: NJ DEP Application 564
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	NONE REPORTED
MAINTENANCE OPERATION RECORDS	NO INFORMATION AVAILABLE

ITEM	REMARKS	
SPILLWAY PLAN	*Emergency Spillway Plan, Profiles*	
SECTIONS	Damsite & Lake Area	Prepared by & Source
	Newark, YMCA Dam	US Department of Agriculture
DETAILS	Sandston Township	Soil Conservation Service
	Sussex County, New Jersey	Drawing NO. NJ 625-P, Sheets 2 of 4 and 3 of 4, 1963
OPERATING EQUIPMENT PLANS & DETAILS	16 inch Sluice Gate Shown on Structural & Steel Detail Newark YMCA Dam Sandyston Township Sussex County, New Jersey	Prepared by: US Department of Agriculture Soil Conservation Service Drawing NO. NJ 625 P Sheet 4 of 4, 1963

APPENDIX 3

PHOTOGRAPHS

Crest of dam looking from left abutment towards right abutment.

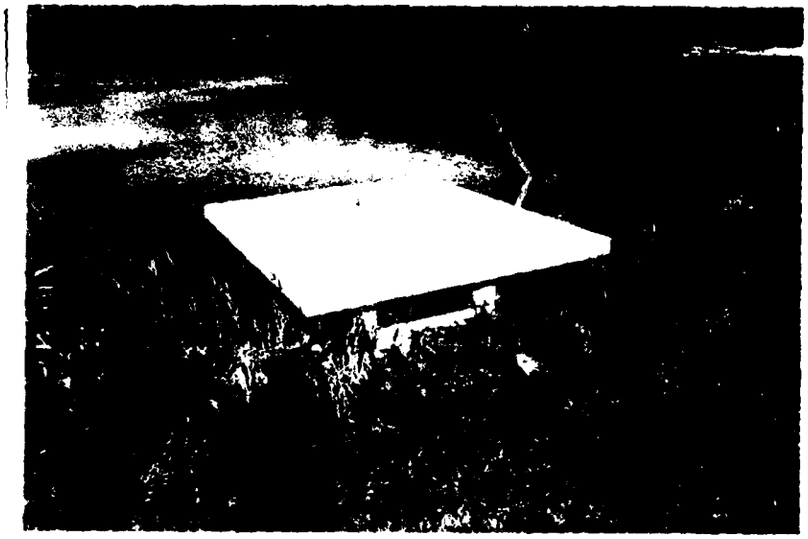
26 September 1980

Downstream embankment viewed from center of dam looking towards left abutment.

26 September 1980

Crest of dam looking from left abutment towards right abutment. 26 September 1980

Downstream embankment viewed from center of dam looking towards left abutment. 26 September 1980



Top of drop inlet spillway. 26 September 1980

Crest of drop inlet spillway. 26 September 1980
Note: Accumulation of branches
and weeds.

Erosion of downstream embankment. 26 September 1980

Drop inlet spillway discharge and channel viewed from top of dam. 26 September 1980

Approach channel of emergency spillway. 26 September 1980

Discharge channel of emergency spillway. 26 September 1980

West shore of reservoir viewed from top of dam. 26 September 1980

East shore of reservoir viewed from top of dam. 26 September 1980

APPENDIX 4

HYDROLOGICAL CALCULATIONS

LANGAN ENGINEERING ASSOCIATES, INC.

HYDROLOGIC COMPUTATIONS

ROBERT ROOKE LAKE DAM

Location: Sussex County, N.J.

Drainage Area: 1.05 sq. mi (670 acres)

Lake Area: 10.8 acres

Classification: Size — small
Hazard — high

Spillway Design Flood:

Based on available information, the dam was designed in 1963 to adequately pass a 6-hr Point Rainfall determined from U.S. Weather Bureau Technical Paper No. 40 and a six-hour Point Rainfall Map developed by the U.S. S.C.S. based on records of maximum rainfalls. This storm is equivalent to 10.2 inches of rainfall and has a peak inflow of 2460 cfs.

In accordance with the Corps of Engineers Screening Criteria, the SDF for dams of small size and high hazard is ½ PMF to PMF. The PMF is chosen for the evaluation of this dam.

BY [illegible] DATE 3/24/81 Robert Rooke Lake Dam JOB NO. 80145
CKD RWG DATE 3/27/81 SHEET NO. 1 OF

LANGAN ENGINEERING ASSOCIATES, INC.

PMP

1. Dam located in Zone 1 (Near boundary to Zone 6)
   PMP = 22.0 inches (for 200 sq. mi, 24 hr. all season envelop)*
2. PMF must be adjusted by a factor of 0.8** to account for the basin size being < 10 sq. mi.

	% Factor (for 10 sq. mi)		
Duration, hrs	Zone 1	Zone 6	Avg
0-6	111	112	112
0-12	123	123	123
0-24	133	132	133
0-48	142	142	142

* HMR #33

** pg. 48 "Design of Small Dam"

BY Dy DATE 3/24/81 Robert Rooks Lake Dam JOB NO. 80145

CKD RBG DATE 3/27/81 SHEET NO. 2 OF

Time of Concentration, T_c

1. Based on the original design by SCS using velocity and length of course method, an estimated $T_c = 0.7$ hr.
2. Using the same data for the water course, i.e.

	Slope of course	Length of course
overland	7%	3000 ft
channel	3%	9000 ft

estimate T_c by curve number method (SCS TR 55)

$$\text{Average slope} = \left(\frac{7 \times 3000 + 3 \times 9000}{12000}\right)\% = 4\%$$

Take CN = 73, $\ell = 12000$ ft, slope = 4%.

from TR 55. Fig. 3.3

$L \doteq 1.3$ hr. or $T_c = \frac{1.3}{0.6} = 2.17$ hr.

Use Avg $T_c = \frac{0.7 + 2.17}{2} = 1.43$ hrs.

$\therefore$ $\boxed{L = 0.6\,T_c \doteq 0.85 \text{ hr.}}$

LANGAN ENGINEERING ASSOCIATES, INC.

BY RWG DATE NOV 12, 1980 OUTFLOW CALCULATIONS JOB NO. 80145

CKD [illegible] DATE 3/27/81 LAKE ROBERT ROOKE SHEET NO. 4 OF

POOL ELEV.	OUTFLOW of DROP INLET * cfs	OUT FLOW EMERGENCY SPILWAY L=120 Ft			OUT FLOW OVER DAM L= 620 Ft			TOTAL OUTFLOW EQ, cfs
		H, ft	C	Q cfs	H, ft	C	Q cfs	
110.0	0							0
111.0	75							75
112.0	212							212
112.7	262	0		0				262
113.0	265	0.3	2.69	53				318
113.5	269	0.8	2.64	227				496
114.0	272	1.3	2.64	470				742
115.0	280	2.3	2.63	1100				1380
115.9	286	3.2	2.63	1807	0		0	2093
116.0	287	3.3	2.63	1892	0.1	2.68	52	2231
117.0	294	4.3	2.63	2814	1.1	2.68	1917	5025

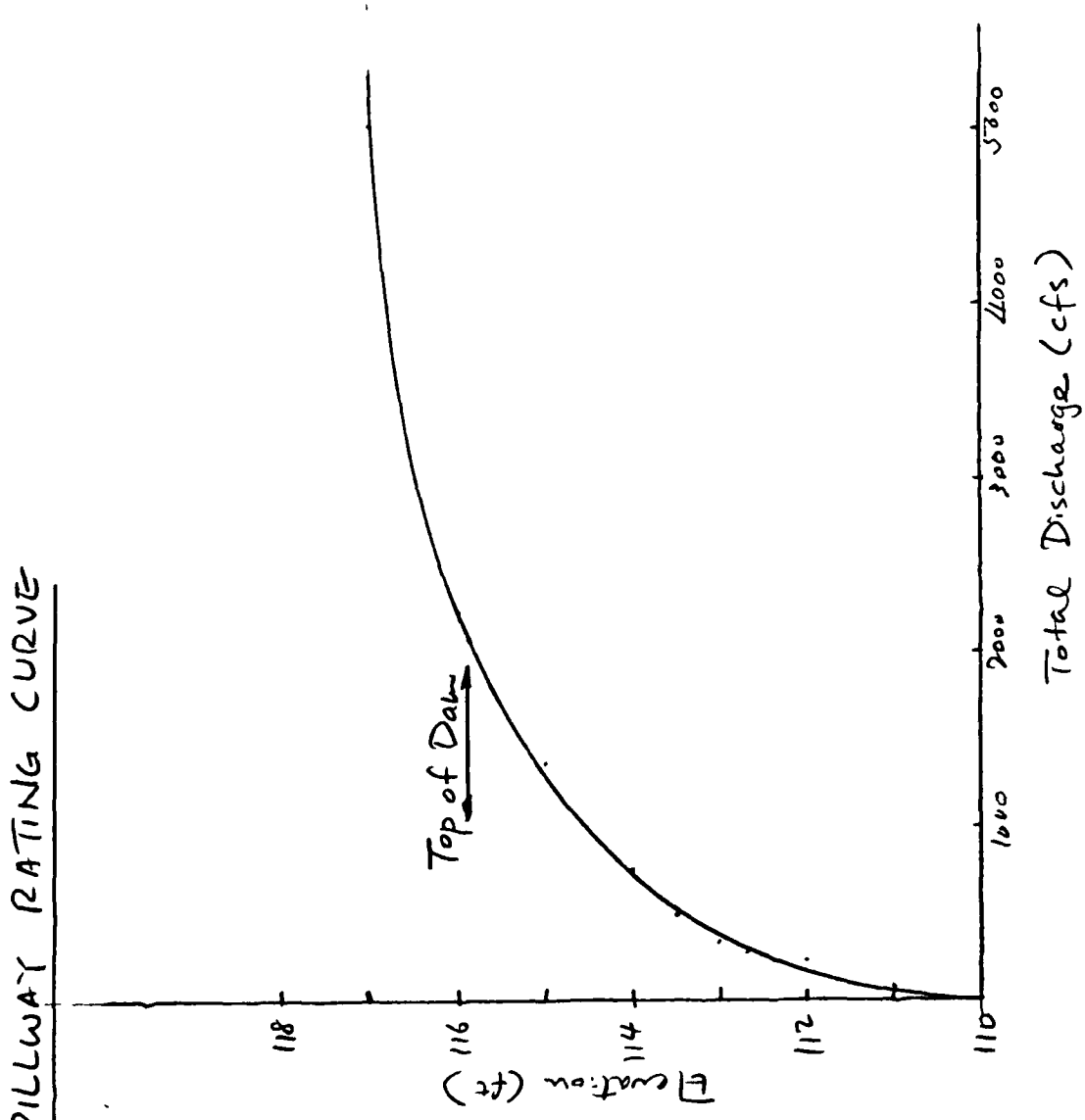
WEIR FLOW OF EMERGENCY SPILLWAY AND OVERDAM DETEMINED BY $Q = CLH^{3/2}$
C VALUES OBTAINED FROM "HANDBOOK of HYDRAULICS", Pg 5-46, TABLE 5-3, bredTH = 15 Ft

* DROP INLET SPILLWAY OUTFLOW FROM SCS CALCULATIONS, $Q = C_p H^{1/2}$, $C_p = 63.8$

DISCHARG CAPACITY

LANGAN ENGINEERING ASSOCIATES, INC.

SPILLWAY RATING CURVE



BY Dmj DATE 3/24/81 Robert Rock Lake Dam JOB NO. 80145

CKD. RWC DATE 3/28/81 SHEET NO. 5 OF

LANGAN ENGINEERING ASSOCIATES, INC.

Reservoir Storage

Data obtained from Design Calculations by U.S Dept of Agriculture Soil Conservation Service dated 3-26-63 for Newark YMCA dam

Elev ft	Storage ac ft
110	0
111	11.5
112	22.9
113	36.0
114	49.2
115	63.5
116	79.5
117	97.5
118	113.9

BY VM DATE 9-30-80 Lake Robert Cooke JOB NO. 3019.5

CKD RWG DATE NOV 25 '80 SHEET NO. 5 OF

LANGAN ENGINEERING ASSOCIATES, INC.

SUMMARY OF HYDROGRAPH AND FLOOD ROUTING

1) Hydrograph & routing calculated using HEC-1.

2) PMF for LAKE ROBert Rooke DAM is 4236 cfs (routed to 4239 cfs).

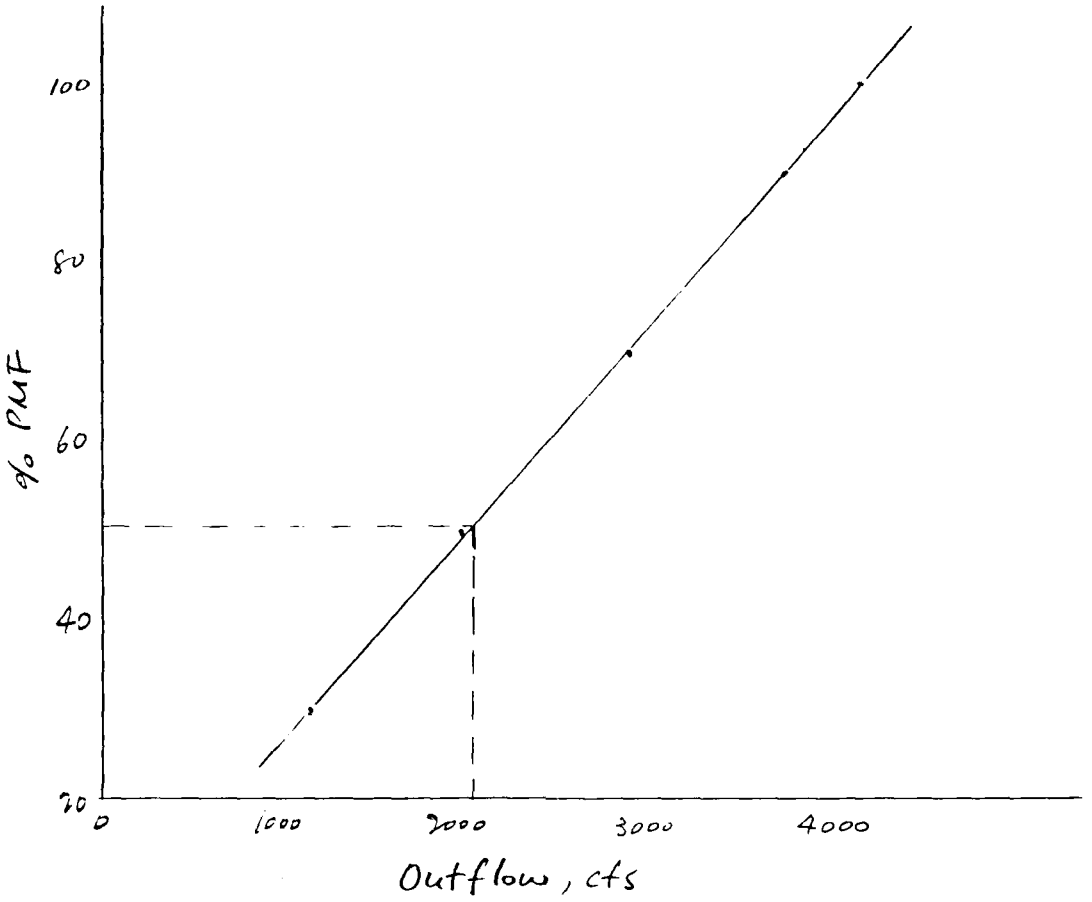
3) Routing of PMF indicates that the dam will overtop by 0.82 ft.

4) Routing of ½ PMF indicates that the dam will not overtop.

BY Py. DATE 5/81 HEC-1 Summary JOB NO. 80145

CKD RWG DATE 5/81 Robert Poole SHEET NO. 6 OF

LANGAN ENGINEERING ASSOCIATES, INC.



% PMF vs Outflow indicates
the dam can adequately pass approx. 51% of PMF
at 2093 cfs

BY [illegible] DATE 5/81 Robert Rooke Dam JOB NO. 80145
CKD RWG DATE 5/81 SHEET NO. 7 OF

LANGAN ENGINEERING ASSOCIATES, INC.

DRAWDOWN ANALYSIS

STRUCTURE

There presently exists a 16" diameter cast iron pipe low level outlet structure. Its operating condition is unknown, however for this analysis we will assume the structure to be operable.

OUTFLOW CAPACITY

Pipe diam. = 16" ($n = .025$)
Length = 36 ft Invert = 97
Normal pool = 110.0 & invert = 97.67
Flow will be calculated using $Q = C_p H^{1/2}$
where $C_p = A_p \sqrt{\frac{2g}{1 + K_m + K_p L}}$
$A_p = 1.40 ft^2$
$K_m = .90$ $K_p = .0189$ $\therefore C_p = 5.16$
$Q = 5.16 H^{1/2}$

Elev. (ft)	Head (ft)	Q (cfs)	Qoutflow (cfs)
110	12.33	18	
109	11.33	17.37	17.7
107	9.33	15.76	16.6
106	8.33	14.9	15.35
104	6.33	12.9	13.9
102	4.33	10.7	11.8
100	2.33	7.8	9.25
98	.33	2.9	5.35
97	0	0	1.45

BY MW DATE 9-29-80 Lake Robert Route JOB NO. 80195
CKD [illegible] DATE 5/81 drawdown SHEET NO. 8 OF

LANGAN ENGINEERING ASSOCIATES, INC.

STORAGE

Elev. (ft)	Area (ac)	Average Area (ac)	ΔH (ft)	Incr. Volume (ac-ft)	Volume (ac-ft)
110	10.75	10.40	1	10.40	68.97
109	10.04	9.18	2	18.36	58.57
107	8.32	7.83	1	7.83	40.21
106	7.33	6.35	2	12.70	32.38
104	5.36	4.57	2	9.14	19.68
102	3.77	3.05	2	6.10	10.54
100	2.33	1.67	2	3.34	4.44
98	1.01	0.55	2	1.10	1.10
96	0.08				

Data acquired from SCS design calculations
See Appendix 1.

BY [illegible] DATE 5/81 Lake Robert Poole Dam JOB NO. 80145
CKD RWG DATE 5/81 SHEET NO. 9 OF

LANGAN ENGINEERING ASSOCIATES, INC.

Assume inflow to be 2 cfs/sq mi

$Q_{in} = 2 \times 1.05 = 2.1$ cfs

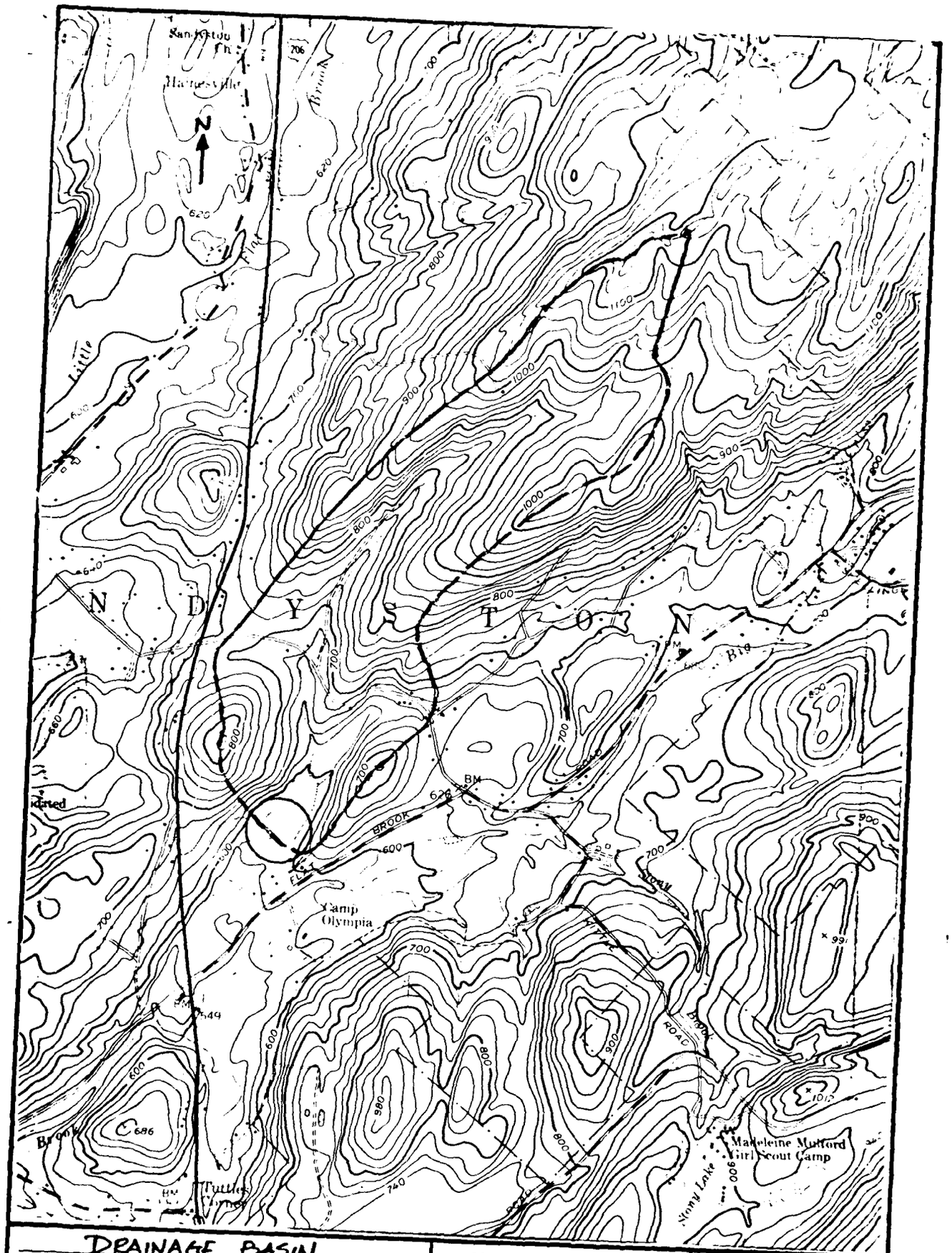
Elev. (ft)	$Q_{out\ avg}$ (cfs)	Q_{net}* (cfs)	ΔStorage (ac-ft)	Δt (hrs)	$\Sigma \Delta t$ (hrs)	
110						
	17.7	15.6	10.40	8.07	8.07	
109						
	16.6	14.5	18.36	15.32	23.39	— 1 day
107						
	15.35	13.25	7.83	7.15	30.54	
106						
	13.9	11.8	12.70	13.02	43.56	
104						
	11.8	9.7	9.14	11.40	54.96	
102						
	9.25	7.15	6.10	10.32	65.28	
100						
	5.35	3.25	3.34	12.44	77.72	— 3 d.
98						
	1.45	—	1.10	—		
97						

* $Q_{net} = Q_{out\ avg} - Q_{in} = Q_{out\ avg} - 10$

Lake can be lowered 3 ft in about 1 day and 12 ft in about 3 days.

BY RJG DATE 5/81 Lake Robert Route Dam JOB NO. 80145

CKD RWG DATE 5/81 SHEET NO. 10 OF



DRAINAGE BASIN
ROBERT ROOKE DAM

MAP SOURCE USGS
CULVERS GAP SCALE: 1" : 2000'

PROJ NO. 80145

SHEET ____ OF ____

LANGAN ENGINEERING ASSOCIATES, INC.

HEC-1 OUTPUT

LAKE ROBERT ROOKE DAM

```
ROOKOUT     16:51 MAY 16,'81

1*********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  26 FEB 79
 *********************************
     1              A1                LAKE ROBERT ROOKE DAM (00262)
     2              A2                INFLOW HYDROGRAPHY AND ROUTING
     3              A3                N J DAM INSPECTION
     4              B     290       0      10       0       0       0       0       0       0       0
     5              B1      3
     6              K       0       1                                       1
     7              K1 COMPUTE HYDROGRAPH
     8              M       1       2    1.05                     .80
     9              P       0    22.0     112     123     133     142
    10              T                                                       1     .15
    11              W2            .85
    12              X      -2               1
    13              K       1       2                                       1
    14              K1 ROUTING COMPUTATIONS
    15              Y                                1
    16              Y1      1                                                      -1
    17              Y4    110     111   112.7   113.0   113.5   114.0   115.0   115.9   116.0   117.0
    18              Y5      0      75     262     318     496     742    1380    2093    2231    5025
    19              $S      0    11.5    22.9    36.0    49.2    63.5    79.5    97.5   113.9
    20              $E  110.0   111.0   112.0   113.0   114.0   115.0   116.0   117.0   118.0
    21              $$    110
    22              $D  115.9
    23              K      99
1                              PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                     RUNOFF HYDROGRAPH AT          1
                                     ROUTE HYDROGRAPH TO           2
                                     END OF NETWORK


1*********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  26 FEB 79
 *********************************

 RUN  DATE# 81/05/16.
      TIME# 16.50.47.


                                 LAKE ROBERT ROOKE DAM (00262)
                                 INFLOW HYDROGRAPHY AND ROUTING
                                 N J DAM INSPECTION

                                          JOB SPECIFICATION
                      NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
                     290       0      10       0       0       0       0       0       0       0
                                         JOPER     NWT   LROPT   TRACE
                                             3       0       0       0


          **********          **********          **********          **********          **********

                                          SUB-AREA RUNOFF COMPUTATION
```

COMPUTE HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	1.05	0.00	1.05	.80	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.00	112.00	123.00	133.00	142.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.15	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= .85

RECESSION DATA

STRTQ= -2.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 27 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .85 VOL= 1.00

46. 140. 292. 454. 535. 539. 486. 408. 300. 217.
162. 124. 93. 69. 52. 38. 28. 21. 16. 12.
9. 7. 5. 4. 3. 2. 1.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.10	1	.00	0.00	.00	2.	1.02	.20	146	.02	0.00	.02	2.
1.01	.20	2	.00	0.00	.00	2.	1.02	.30	147	.02	0.00	.02	2.
1.01	.30	3	.00	0.00	.00	2.	1.02	.40	148	.02	0.00	.02	2.
1.01	.40	4	.00	0.00	.00	2.	1.02	.50	149	.02	0.00	.02	2.
1.01	.50	5	.00	0.00	.00	2.	1.02	1.00	150	.02	0.00	.02	2.
1.01	1.00	6	.00	0.00	.00	2.	1.02	1.10	151	.02	0.00	.02	2.
1.01	1.10	7	.00	0.00	.00	2.	1.02	1.20	152	.02	0.00	.02	2.
1.01	1.20	8	.00	0.00	.00	2.	1.02	1.30	153	.02	0.00	.02	2.
1.01	1.30	9	.00	0.00	.00	2.	1.02	1.40	154	.02	0.00	.02	2.
1.01	1.40	10	.00	0.00	.00	2.	1.02	1.50	155	.02	0.00	.02	2.
1.01	1.50	11	.00	0.00	.00	2.	1.02	2.00	156	.02	0.00	.02	2.
1.01	2.00	12	.00	0.00	.00	2.	1.02	2.10	157	.02	0.00	.02	2.
1.01	2.10	13	.00	0.00	.00	2.	1.02	2.20	158	.02	0.00	.02	2.
1.01	2.20	14	.00	0.00	.00	2.	1.02	2.30	159	.02	0.00	.02	2.
1.01	2.30	15	.00	0.00	.00	2.	1.02	2.40	160	.02	0.00	.02	2.
1.01	2.40	16	.00	0.00	.00	2.	1.02	2.50	161	.02	0.00	.02	2.
1.01	2.50	17	.00	0.00	.00	2.	1.02	3.00	162	.02	0.00	.02	2.
1.01	3.00	18	.00	0.00	.00	2.	1.02	3.10	163	.02	0.00	.02	2.
1.01	3.10	19	.00	0.00	.00	2.	1.02	3.20	164	.02	0.00	.02	2.
1.01	3.20	20	.00	0.00	.00	2.	1.02	3.30	165	.02	0.00	.02	2.
1.01	3.30	21	.00	0.00	.00	2.	1.02	3.40	166	.02	0.00	.02	2.
1.01	3.40	22	.00	0.00	.00	2.	1.02	3.50	167	.02	0.00	.02	2.
1.01	3.50	23	.00	0.00	.00	2.	1.02	4.00	168	.02	0.00	.02	2.
1.01	4.00	24	.00	0.00	.00	2.	1.02	4.10	169	.02	0.00	.02	2.
1.01	4.10	25	.00	0.00	.00	2.	1.02	4.20	170	.02	0.00	.02	2.
1.01	4.20	26	.00	0.00	.00	2.	1.02	4.30	171	.02	0.00	.02	2.
1.01	4.30	27	.00	0.00	.00	2.	1.02	4.40	172	.02	0.00	.02	2.
1.01	4.40	28	.00	0.00	.00	2.	1.02	4.50	173	.02	0.00	.02	2.
1.01	4.50	29	.00	0.00	.00	2.	1.02	5.00	174	.02	0.00	.02	2.
1.01	5.00	30	.00	0.00	.00	2.	1.02	5.10	175	.02	0.00	.02	2.
1.01	5.10	31	.00	0.00	.00	2.	1.02	5.20	176	.02	0.00	.02	2.
1.01	5.20	32	.00	0.00	.00	2.	1.02	5.30	177	.02	0.00	.02	2.
1.01	5.30	33	.00	0.00	.00	2.	1.02	5.40	178	.02	0.00	.02	2.
1.01	5.40	34	.00	0.00	.00	2.	1.02	5.50	179	.02	0.00	.02	2.

1.01	6.00	36	.00	0.00	.00	2.	1.02	6.10	181	.05	.03	.03	3.
1.01	6.10	37	.00	0.00	.00	2.	1.02	6.20	182	.05	.03	.03	7.
1.01	6.20	38	.00	0.00	.00	2.	1.02	6.30	183	.05	.03	.03	16.
1.01	6.30	39	.00	0.00	.00	2.	1.02	6.40	184	.05	.03	.03	29.
1.01	6.40	40	.00	0.00	.00	2.	1.02	6.50	185	.05	.03	.03	44.
1.01	6.50	41	.00	0.00	.00	2.	1.02	7.00	186	.05	.03	.03	60.
1.01	7.00	42	.00	0.00	.00	2.	1.02	7.10	187	.05	.03	.03	74.
1.01	7.10	43	.00	0.00	.00	2.	1.02	7.20	188	.05	.03	.03	86.
1.01	7.20	44	.00	0.00	.00	2.	1.02	7.30	189	.05	.03	.03	94.
1.01	7.30	45	.00	0.00	.00	2.	1.02	7.40	190	.05	.03	.03	100.
1.01	7.40	46	.00	0.00	.00	2.	1.02	7.50	191	.05	.03	.03	105.
1.01	7.50	47	.00	0.00	.00	2.	1.02	8.00	192	.05	.03	.03	109.
1.01	8.00	48	.00	0.00	.00	2.	1.02	8.10	193	.05	.03	.03	111.
1.01	8.10	49	.00	0.00	.00	2.	1.02	8.20	194	.05	.03	.03	113.
1.01	8.20	50	.00	0.00	.00	2.	1.02	8.30	195	.05	.03	.03	115.
1.01	8.30	51	.00	0.00	.00	2.	1.02	8.40	196	.05	.03	.03	116.
1.01	8.40	52	.00	0.00	.00	2.	1.02	8.50	197	.05	.03	.03	117.
1.01	8.50	53	.00	0.00	.00	2.	1.02	9.00	198	.05	.03	.03	117.
1.01	9.00	54	.00	0.00	.00	2.	1.02	9.10	199	.05	.03	.03	118.
1.01	9.10	55	.00	0.00	.00	2.	1.02	9.20	200	.05	.03	.03	118.
1.01	9.20	56	.00	0.00	.00	2.	1.02	9.30	201	.05	.03	.03	118.
1.01	9.30	57	.00	0.00	.00	2.	1.02	9.40	202	.05	.03	.03	119.
1.01	9.40	58	.00	0.00	.00	2.	1.02	9.50	203	.05	.03	.03	119.
1.01	9.50	59	.00	0.00	.00	2.	1.02	10.00	204	.05	.03	.03	119.
1.01	10.00	60	.00	0.00	.00	2.	1.02	10.10	205	.05	.03	.03	119.
1.01	10.10	61	.00	0.00	.00	2.	1.02	10.20	206	.05	.03	.03	119.
1.01	10.20	62	.00	0.00	.00	2.	1.02	10.30	207	.05	.03	.03	119.
1.01	10.30	63	.00	0.00	.00	2.	1.02	10.40	208	.05	.03	.03	119.
1.01	10.40	64	.00	0.00	.00	2.	1.02	10.50	209	.05	.03	.03	119.
1.01	10.50	65	.00	0.00	.00	2.	1.02	11.00	210	.05	.03	.03	119.
1.01	11.00	66	.00	0.00	.00	2.	1.02	11.10	211	.05	.03	.03	119.
1.01	11.10	67	.00	0.00	.00	2.	1.02	11.20	212	.05	.03	.03	119.
1.01	11.20	68	.00	0.00	.00	2.	1.02	11.30	213	.05	.03	.03	119.
1.01	11.30	69	.00	0.00	.00	2.	1.02	11.40	214	.05	.03	.03	119.
1.01	11.40	70	.00	0.00	.00	2.	1.02	11.50	215	.05	.03	.03	119.
1.01	11.50	71	.00	0.00	.00	2.	1.02	12.00	216	.05	.03	.03	119.
1.01	12.00	72	.00	0.00	.00	2.	1.02	12.10	217	.33	.30	.03	132.
1.01	12.10	73	.02	0.00	.02	2.	1.02	12.20	218	.33	.30	.03	170.
1.01	12.20	74	.02	0.00	.02	2.	1.02	12.30	219	.33	.30	.03	251.
1.01	12.30	75	.02	0.00	.02	2.	1.02	12.40	220	.33	.30	.03	375.
1.01	12.40	76	.02	0.00	.02	2.	1.02	12.50	221	.33	.30	.03	522.
1.01	12.50	77	.02	0.00	.02	2.	1.02	13.00	222	.33	.30	.03	670.
1.01	13.00	78	.02	0.00	.02	2.	1.02	13.10	223	.39	.37	.03	807.
1.01	13.10	79	.03	0.00	.03	2.	1.02	13.20	224	.39	.37	.03	928.
1.01	13.20	80	.03	0.00	.03	2.	1.02	13.30	225	.39	.37	.03	1030.
1.01	13.30	81	.03	0.00	.03	2.	1.02	13.40	226	.39	.37	.03	1119.
1.01	13.40	82	.03	0.00	.03	2.	1.02	13.50	227	.39	.37	.03	1199.
1.01	13.50	83	.03	0.00	.03	2.	1.02	14.00	228	.39	.37	.03	1268.
1.01	14.00	84	.03	0.00	.03	2.	1.02	14.10	229	.49	.47	.03	1330.
1.01	14.10	85	.03	0.00	.03	2.	1.02	14.20	230	.49	.47	.03	1390.
1.01	14.20	86	.03	0.00	.03	2.	1.02	14.30	231	.49	.47	.03	1453.
1.01	14.30	87	.03	0.00	.03	2.	1.02	14.40	232	.49	.47	.03	1522.
1.01	14.40	88	.03	0.00	.03	2.	1.02	14.50	233	.49	.47	.03	1593.
1.01	14.50	89	.03	0.00	.03	2.	1.02	15.00	234	.49	.47	.03	1660.
1.01	15.00	90	.03	0.00	.03	2.	1.02	15.10	235	.45	.42	.03	1717.
1.01	15.10	91	.03	0.00	.03	2.	1.02	15.20	236	.75	.72	.03	1773.
1.01	15.20	92	.05	0.00	.05	2.	1.02	15.30	237	1.35	1.32	.03	1865.
1.01	15.30	93	.09	0.00	.09	2.	1.02	15.40	238	3.37	3.35	.03	2136.
1.01	15.40	94	.23	.06	.16	5.	1.02	15.50	239	.97	.95	.03	2614.
1.01	15.50	95	.07	.04	.03	13.	1.02	16.00	240	.60	.57	.03	3277.
1.01	16.00	96	.04	.02	.03	27.	1.02	16.10	241	.46	.43	.03	3908.
1.01	16.10	97	.03	.01	.03	46.	1.02	16.20	242	.46	.43	.03	4233.
1.01	16.20	98	.03	.01	.03	61.	1.02	16.30	243	.46	.43	.03	4236.
1.01	16.30	99	.03	.01	.03	69.	1.02	16.40	244	.46	.43	.03	3992.
1.01	16.40	100	.03	.01	.03	70.	1.02	16.50	245	.46	.43	.03	3617.

1.01	17.00	102	.03	.01	.03	58.	1.02	17.10	247	.36	.34	.03	2791.
1.01	17.10	103	.02	0.00	.02	50.	1.02	17.20	248	.36	.34	.03	2515.
1.01	17.20	104	.02	0.00	.02	43.	1.02	17.30	249	.36	.34	.03	2300.
1.01	17.30	105	.02	0.00	.02	37.	1.02	17.40	250	.36	.34	.03	2111.
1.01	17.40	106	.02	0.00	.02	31.	1.02	17.50	251	.36	.34	.03	1949.
1.01	17.50	107	.02	0.00	.02	25.	1.02	18.00	252	.36	.34	.03	1814.
1.01	18.00	108	.02	0.00	.02	20.	1.02	18.10	253	.03	.00	.03	1689.
1.01	18.10	109	.00	0.00	.00	16.	1.02	18.20	254	.03	.00	.03	1556.
1.01	18.20	110	.00	0.00	.00	12.	1.02	18.30	255	.03	.00	.03	1395.
1.01	18.30	111	.00	0.00	.00	10.	1.02	18.40	256	.03	.00	.03	1198.
1.01	18.40	112	.00	0.00	.00	8.	1.02	18.50	257	.03	.00	.03	986.
1.01	18.50	113	.00	0.00	.00	6.	1.02	19.00	258	.03	.00	.03	780.
1.01	19.00	114	.00	0.00	.00	5.	1.02	19.10	259	.03	.00	.03	600.
1.01	19.10	115	.00	0.00	.00	4.	1.02	19.20	260	.03	.00	.03	450.
1.01	19.20	116	.00	0.00	.00	4.	1.02	19.30	261	.03	.00	.03	340.
1.01	19.30	117	.00	0.00	.00	3.	1.02	19.40	262	.03	.00	.03	258.
1.01	19.40	118	.00	0.00	.00	3.	1.02	19.50	263	.03	.00	.03	197.
1.01	19.50	119	.00	0.00	.00	3.	1.02	20.00	264	.03	.00	.03	149.
1.01	20.00	120	.00	0.00	.00	3.	1.02	20.10	265	.03	.00	.03	114.
1.01	20.10	121	.00	0.00	.00	2.	1.02	20.20	266	.03	.00	.03	89.
1.01	20.20	122	.00	0.00	.00	2.	1.02	20.30	267	.03	.00	.03	71.
1.01	20.30	123	.00	0.00	.00	2.	1.02	20.40	268	.03	.00	.03	57.
1.01	20.40	124	.00	0.00	.00	2.	1.02	20.50	269	.03	.00	.03	47.
1.01	20.50	125	.00	0.00	.00	2.	1.02	21.00	270	.03	.00	.03	40.
1.01	21.00	126	.00	0.00	.00	2.	1.02	21.10	271	.03	.00	.03	34.
1.01	21.10	127	.00	0.00	.00	2.	1.02	21.20	272	.03	.00	.03	30.
1.01	21.20	128	.00	0.00	.00	2.	1.02	21.30	273	.03	.00	.03	27.
1.01	21.30	129	.00	0.00	.00	2.	1.02	21.40	274	.03	.00	.03	25.
1.01	21.40	130	.00	0.00	.00	2.	1.02	21.50	275	.03	.00	.03	23.
1.01	21.50	131	.00	0.00	.00	2.	1.02	22.00	276	.03	.00	.03	22.
1.01	22.00	132	.00	0.00	.00	2.	1.02	22.10	277	.03	.00	.03	21.
1.01	22.10	133	.00	0.00	.00	2.	1.02	22.20	278	.03	.00	.03	20.
1.01	22.20	134	.00	0.00	.00	2.	1.02	22.30	279	.03	.00	.03	20.
1.01	22.30	135	.00	0.00	.00	2.	1.02	22.40	280	.03	.00	.03	20.
1.01	22.40	136	.00	0.00	.00	2.	1.02	22.50	281	.03	.00	.03	20.
1.01	22.50	137	.00	0.00	.00	2.	1.02	23.00	282	.03	.00	.03	20.
1.01	23.00	138	.00	0.00	.00	2.	1.02	23.10	283	.03	.00	.03	20.
1.01	23.10	139	.00	0.00	.00	2.	1.02	23.20	284	.03	.00	.03	20.
1.01	23.20	140	.00	0.00	.00	2.	1.02	23.30	285	.03	.00	.03	20.
1.01	23.30	141	.00	0.00	.00	2.	1.02	23.40	286	.03	.00	.03	20.
1.01	23.40	142	.00	0.00	.00	2.	1.02	23.50	287	.03	.00	.03	20.
1.01	23.50	143	.00	0.00	.00	2.	1.03	0.00	288	.03	.00	.03	20.
1.02	0.00	144	.00	0.00	.00	2.	1.03	.10	289	0.00	0.00	0.00	20.
1.02	.10	145	.02	0.00	.02	2.	1.03	.20	290	0.00	0.00	0.00	19.
									SUM	24.99	20.16	4.83	82450.
										(635.)	(512.)	(123.)	(2334.72)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4236.	2024.	566.	284.	82451.
CMS	120.	57.	16.	8.	2335.
INCHES		17.93	20.06	20.29	20.29
MM		455.44	509.47	515.38	515.38
AC-FT		1004.	1123.	1136.	1136.
THOUS CU M		1238.	1385.	1401.	1401.

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HYDROGRAPH ROUTING

ROUTING COMPUTATIONS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	-1

STAGE	110.00	111.00	112.70	113.00	113.50	114.00	115.00	115.90	116.00
FLOW	0.00	75.00	262.00	318.00	496.00	742.00	1380.00	2093.00	2231.00
CAPACITY=	0.	12.	23.	36.	49.	64.	80.	98.	114.
ELEVATION=	110.	111.	112.	113.	114.	115.	116.	117.	118.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
110.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
115.9	0.0	0.0	0.

END-OF-PERIOD HYDROGRAPH ORDINATES

MO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	.10	1	.17	2.	0.	0.	110.0
1.01	.20	2	.33	2.	0.	0.	110.0
1.01	.30	3	.50	2.	0.	0.	110.0
1.01	.40	4	.67	2.	1.	0.	110.0
1.01	.50	5	.83	2.	1.	0.	110.0
1.01	1.00	6	1.00	2.	1.	0.	110.0
1.01	1.10	7	1.17	2.	1.	0.	110.0
1.01	1.20	8	1.33	2.	1.	0.	110.0
1.01	1.30	9	1.50	2.	1.	0.	110.0
1.01	1.40	10	1.67	2.	1.	0.	110.0
1.01	1.50	11	1.83	2.	1.	0.	110.0
1.01	2.00	12	2.00	2.	1.	0.	110.0
1.01	2.10	13	2.17	2.	1.	0.	110.0
1.01	2.20	14	2.33	2.	2.	0.	110.0
1.01	2.30	15	2.50	2.	2.	0.	110.0
1.01	2.40	16	2.67	2.	2.	0.	110.0
1.01	2.50	17	2.83	2.	2.	0.	110.0
1.01	3.00	18	3.00	2.	2.	0.	110.0
1.01	3.10	19	3.17	2.	2.	0.	110.0
1.01	3.20	20	3.33	2.	2.	0.	110.0
1.01	3.30	21	3.50	2.	2.	0.	110.0
1.01	3.40	22	3.67	2.	2.	0.	110.0
1.01	3.50	23	3.83	2.	2.	0.	110.0
1.01	4.00	24	4.00	2.	2.	0.	110.0
1.01	4.10	25	4.17	2.	2.	0.	110.0
1.01	4.20	26	4.33	2.	2.	0.	110.0
1.01	4.30	27	4.50	2.	2.	0.	110.0
1.01	4.40	28	4.67	2.	2.	0.	110.0
1.01	4.50	29	4.83	2.	2.	0.	110.0
1.01	5.00	30	5.00	2.	2.	0.	110.0
1.01	5.10	31	5.17	2.	2.	0.	110.0
1.01	5.20	32	5.33	2.	2.	0.	110.0
1.01	5.30	33	5.50	2.	2.	0.	110.0
1.01	5.40	34	5.67	2.	2.	0.	110.0
1.01	5.50	35	5.83	2.	2.	0.	110.0
1.01	6.00	36	6.00	2.	2.	0.	110.0
1.01	6.10	37	6.17	2.	2.	0.	110.0
1.01	6.20	38	6.33	2.	2.	0.	110.0

1.01	6.40	40	6.67	2.	2.	0.	110.0
1.01	6.50	41	6.83	2.	2.	0.	110.0
1.01	7.00	42	7.00	2.	2.	0.	110.0
1.01	7.10	43	7.17	2.	2.	0.	110.0
1.01	7.20	44	7.33	2.	2.	0.	110.0
1.01	7.30	45	7.50	2.	2.	0.	110.0
1.01	7.40	46	7.67	2.	2.	0.	110.0
1.01	7.50	47	7.83	2.	2.	0.	110.0
1.01	8.00	48	8.00	2.	2.	0.	110.0
1.01	8.10	49	8.17	2.	2.	0.	110.0
1.01	8.20	50	8.33	2.	2.	0.	110.0
1.01	8.30	51	8.50	2.	2.	0.	110.0
1.01	8.40	52	8.67	2.	2.	0.	110.0
1.01	8.50	53	8.83	2.	2.	0.	110.0
1.01	9.00	54	9.00	2.	2.	0.	110.0
1.01	9.10	55	9.17	2.	2.	0.	110.0
1.01	9.20	56	9.33	2.	2.	0.	110.0
1.01	9.30	57	9.50	2.	2.	0.	110.0
1.01	9.40	58	9.67	2.	2.	0.	110.0
1.01	9.50	59	9.83	2.	2.	0.	110.0
1.01	10.00	60	10.00	2.	2.	0.	110.0
1.01	10.10	61	10.17	2.	2.	0.	110.0
1.01	10.20	62	10.33	2.	2.	0.	110.0
1.01	10.30	63	10.50	2.	2.	0.	110.0
1.01	10.40	64	10.67	2.	2.	0.	110.0
1.01	10.50	65	10.83	2.	2.	0.	110.0
1.01	11.00	66	11.00	2.	2.	0.	110.0
1.01	11.10	67	11.17	2.	2.	0.	110.0
1.01	11.20	68	11.33	2.	2.	0.	110.0
1.01	11.30	69	11.50	2.	2.	0.	110.0
1.01	11.40	70	11.67	2.	2.	0.	110.0
1.01	11.50	71	11.83	2.	2.	0.	110.0
1.01	12.00	72	12.00	2.	2.	0.	110.0
1.01	12.10	73	12.17	2.	2.	0.	110.0
1.01	12.20	74	12.33	2.	2.	0.	110.0
1.01	12.30	75	12.50	2.	2.	0.	110.0
1.01	12.40	76	12.67	2.	2.	0.	110.0
1.01	12.50	77	12.83	2.	2.	0.	110.0
1.01	13.00	78	13.00	2.	2.	0.	110.0
1.01	13.10	79	13.17	2.	2.	0.	110.0
1.01	13.20	80	13.33	2.	2.	0.	110.0
1.01	13.30	81	13.50	2.	2.	0.	110.0
1.01	13.40	82	13.67	2.	2.	0.	110.0
1.01	13.50	83	13.83	2.	2.	0.	110.0
1.01	14.00	84	14.00	2.	2.	0.	110.0
1.01	14.10	85	14.17	2.	2.	0.	110.0
1.01	14.20	86	14.33	2.	2.	0.	110.0
1.01	14.30	87	14.50	2.	2.	0.	110.0
1.01	14.40	88	14.67	2.	2.	0.	110.0
1.01	14.50	89	14.83	2.	2.	0.	110.0
1.01	15.00	90	15.00	2.	2.	0.	110.0
1.01	15.10	91	15.17	2.	2.	0.	110.0
1.01	15.20	92	15.33	2.	2.	0.	110.0
1.01	15.30	93	15.50	2.	2.	0.	110.0
1.01	15.40	94	15.67	5.	2.	0.	110.0
1.01	15.50	95	15.83	13.	3.	0.	110.0
1.01	16.00	96	16.00	27.	4.	1.	110.1
1.01	16.10	97	16.17	46.	7.	1.	110.1
1.01	16.20	98	16.33	61.	11.	2.	110.1
1.01	16.30	99	16.50	69.	16.	2.	110.2
1.01	16.40	100	16.67	70.	20.	3.	110.3
1.01	16.50	101	16.83	66.	24.	4.	110.3
1.01	17.00	102	17.00	58.	28.	4.	110.4
1.01	17.10	103	17.17	50.	30.	5.	110.4
1.01	17.20	104	17.33	43.	31.	5.	110.4

1.01	17.40	106	17.67	31.	32.	5.	110.4
1.01	17.50	107	17.83	25.	32.	5.	110.4
1.01	18.00	108	18.00	20.	31.	5.	110.4
1.01	18.10	109	18.17	16.	30.	5.	110.4
1.01	18.20	110	18.33	12.	29.	4.	110.4
1.01	18.30	111	18.50	10.	27.	4.	110.4
1.01	18.40	112	18.67	8.	25.	4.	110.3
1.01	18.50	113	18.83	6.	24.	4.	110.3
1.01	19.00	114	19.00	5.	22.	3.	110.3
1.01	19.10	115	19.17	4.	21.	3.	110.3
1.01	19.20	116	19.33	4.	19.	3.	110.3
1.01	19.30	117	19.50	3.	18.	3.	110.2
1.01	19.40	118	19.67	3.	17.	3.	110.2
1.01	19.50	119	19.83	3.	16.	2.	110.2
1.01	20.00	120	20.00	3.	14.	2.	110.2
1.01	20.10	121	20.17	2.	13.	2.	110.2
1.01	20.20	122	20.33	2.	12.	2.	110.2
1.01	20.30	123	20.50	2.	12.	2.	110.2
1.01	20.40	124	20.67	2.	11.	2.	110.1
1.01	20.50	125	20.83	2.	10.	2.	110.1
1.01	21.00	126	21.00	2.	9.	1.	110.1
1.01	21.10	127	21.17	2.	9.	1.	110.1
1.01	21.20	128	21.33	2.	8.	1.	110.1
1.01	21.30	129	21.50	2.	8.	1.	110.1
1.01	21.40	130	21.67	2.	7.	1.	110.1
1.01	21.50	131	21.83	2.	7.	1.	110.1
1.01	22.00	132	22.00	2.	6.	1.	110.1
1.01	22.10	133	22.17	2.	6.	1.	110.1
1.01	22.20	134	22.33	2.	6.	1.	110.1
1.01	22.30	135	22.50	2.	5.	1.	110.1
1.01	22.40	136	22.67	2.	5.	1.	110.1
1.01	22.50	137	22.83	2.	5.	1.	110.1
1.01	23.00	138	23.00	2.	5.	1.	110.1
1.01	23.10	139	23.17	2.	4.	1.	110.1
1.01	23.20	140	23.33	2.	4.	1.	110.1
1.01	23.30	141	23.50	2.	4.	1.	110.1
1.01	23.40	142	23.67	2.	4.	1.	110.1
1.01	23.50	143	23.83	2.	4.	1.	110.0
1.02	0.00	144	24.00	2.	4.	1.	110.0
1.02	.10	145	24.17	2.	3.	1.	110.0
1.02	.20	146	24.33	2.	3.	1.	110.0
1.02	.30	147	24.50	2.	3.	0.	110.0
1.02	.40	148	24.67	2.	3.	0.	110.0
1.02	.50	149	24.83	2.	3.	0.	110.0
1.02	1.00	150	25.00	2.	3.	0.	110.0
1.02	1.10	151	25.17	2.	3.	0.	110.0
1.02	1.20	152	25.33	2.	3.	0.	110.0
1.02	1.30	153	25.50	2.	3.	0.	110.0
1.02	1.40	154	25.67	2.	3.	0.	110.0
1.02	1.50	155	25.83	2.	3.	0.	110.0
1.02	2.00	156	26.00	2.	3.	0.	110.0
1.02	2.10	157	26.17	2.	3.	0.	110.0
1.02	2.20	158	26.33	2.	3.	0.	110.0
1.02	2.30	159	26.50	2.	2.	0.	110.0
1.02	2.40	160	26.67	2.	2.	0.	110.0
1.02	2.50	161	26.83	2.	2.	0.	110.0
1.02	3.00	162	27.00	2.	2.	0.	110.0
1.02	3.10	163	27.17	2.	2.	0.	110.0
1.02	3.20	164	27.33	2.	2.	0.	110.0
1.02	3.30	165	27.50	2.	2.	0.	110.0
1.02	3.40	166	27.67	2.	2.	0.	110.0
1.02	3.50	167	27.83	2.	2.	0.	110.0
1.02	4.00	168	28.00	2.	2.	0.	110.0
1.02	4.10	169	28.17	2.	2.	0.	110.0
1.02	4.20	170	28.33	2.	2.	0.	110.0

1.02	4.40	172	28.67	2.	2.	0.	110.0
1.02	4.50	173	28.83	2.	2.	0.	110.0
1.02	5.00	174	29.00	2.	2.	0.	110.0
1.02	5.10	175	29.17	2.	2.	0.	110.0
1.02	5.20	176	29.33	2.	2.	0.	110.0
1.02	5.30	177	29.50	2.	2.	0.	110.0
1.02	5.40	178	29.67	2.	2.	0.	110.0
1.02	5.50	179	29.83	2.	2.	0.	110.0
1.02	6.00	180	30.00	2.	2.	0.	110.0
1.02	6.10	181	30.17	3.	2.	0.	110.0
1.02	6.20	182	30.33	7.	2.	0.	110.0
1.02	6.30	183	30.50	16.	3.	1.	110.0
1.02	6.40	184	30.67	29.	5.	1.	110.1
1.02	6.50	185	30.83	44.	8.	1.	110.1
1.02	7.00	186	31.00	60.	11.	2.	110.2
1.02	7.10	187	31.17	74.	16.	2.	110.2
1.02	7.20	188	31.33	86.	22.	3.	110.3
1.02	7.30	189	31.50	94.	28.	4.	110.4
1.02	7.40	190	31.67	100.	34.	5.	110.4
1.02	7.50	191	31.83	105.	39.	6.	110.5
1.02	8.00	192	32.00	109.	45.	7.	110.6
1.02	8.10	193	32.17	111.	51.	8.	110.7
1.02	8.20	194	32.33	113.	56.	9.	110.7
1.02	8.30	195	32.50	115.	61.	9.	110.8
1.02	8.40	196	32.67	116.	66.	10.	110.9
1.02	8.50	197	32.83	117.	70.	11.	110.9
1.02	9.00	198	33.00	117.	74.	11.	111.0
1.02	9.10	199	33.17	118.	79.	12.	111.0
1.02	9.20	200	33.33	118.	84.	12.	111.1
1.02	9.30	201	33.50	118.	88.	13.	111.1
1.02	9.40	202	33.67	119.	92.	13.	111.2
1.02	9.50	203	33.83	119.	95.	14.	111.2
1.02	10.00	204	34.00	119.	98.	14.	111.2
1.02	10.10	205	34.17	119.	101.	14.	111.2
1.02	10.20	206	34.33	119.	103.	14.	111.3
1.02	10.30	207	34.50	119.	105.	15.	111.3
1.02	10.40	208	34.67	119.	107.	15.	111.3
1.02	10.50	209	34.83	119.	108.	15.	111.3
1.02	11.00	210	35.00	119.	110.	15.	111.3
1.02	11.10	211	35.17	119.	111.	15.	111.3
1.02	11.20	212	35.33	119.	112.	15.	111.3
1.02	11.30	213	35.50	119.	113.	15.	111.3
1.02	11.40	214	35.67	119.	114.	15.	111.4
1.02	11.50	215	35.83	119.	114.	16.	111.4
1.02	12.00	216	36.00	119.	115.	16.	111.4
1.02	12.10	217	36.17	132.	116.	16.	111.4
1.02	12.20	218	36.33	170.	120.	16.	111.4
1.02	12.30	219	36.50	251.	132.	17.	111.5
1.02	12.40	220	36.67	375.	154.	20.	111.7
1.02	12.50	221	36.83	522.	190.	24.	112.0
1.02	13.00	222	37.00	670.	235.	29.	112.5
1.02	13.10	223	37.17	807.	307.	35.	112.9
1.02	13.20	224	37.33	928.	475.	42.	113.4
1.02	13.30	225	37.50	1030.	674.	47.	113.9
1.02	13.40	226	37.67	1119.	852.	52.	114.2
1.02	13.50	227	37.83	1199.	997.	55.	114.4
1.02	14.00	228	38.00	1268.	1108.	57.	114.6
1.02	14.10	229	38.17	1330.	1198.	59.	114.7
1.02	14.20	230	38.33	1390.	1274.	61.	114.8
1.02	14.30	231	38.50	1453.	1343.	63.	114.9
1.02	14.40	232	38.67	1522.	1414.	64.	115.0
1.02	14.50	233	38.83	1593.	1487.	66.	115.1
1.02	15.00	234	39.00	1660.	1558.	67.	115.2
1.02	15.10	235	39.17	1717.	1624.	68.	115.3
1.02	15.20	236	39.33	1773.	1686.	70.	115.4

1.02	4.40	172	28.67	2.	2.	0.	110.0
1.02	4.50	173	28.83	2.	2.	0.	110.0
1.02	5.00	174	29.00	2.	2.	0.	110.0
1.02	5.10	175	29.17	2.	2.	0.	110.0
1.02	5.20	176	29.33	2.	2.	0.	110.0
1.02	5.30	177	29.50	2.	2.	0.	110.0
1.02	5.40	178	29.67	2.	2.	0.	110.0
1.02	5.50	179	29.83	2.	2.	0.	110.0
1.02	6.00	180	30.00	2.	2.	0.	110.0
1.02	6.10	181	30.17	3.	2.	0.	110.0
1.02	6.20	182	30.33	7.	2.	0.	110.0
1.02	6.30	183	30.50	16.	3.	1.	110.0
1.02	6.40	184	30.67	29.	5.	1.	110.1
1.02	6.50	185	30.83	44.	8.	1.	110.1
1.02	7.00	186	31.00	60.	11.	2.	110.2
1.02	7.10	187	31.17	74.	16.	2.	110.2
1.02	7.20	188	31.33	86.	22.	3.	110.3
1.02	7.30	189	31.50	94.	28.	4.	110.4
1.02	7.40	190	31.67	100.	34.	5.	110.4
1.02	7.50	191	31.83	105.	39.	6.	110.5
1.02	8.00	192	32.00	109.	45.	7.	110.6
1.02	8.10	193	32.17	111.	51.	8.	110.7
1.02	8.20	194	32.33	113.	56.	9.	110.7
1.02	8.30	195	32.50	115.	61.	9.	110.8
1.02	8.40	196	32.67	116.	66.	10.	110.9
1.02	8.50	197	32.83	117.	70.	11.	110.9
1.02	9.00	198	33.00	117.	74.	11.	111.0
1.02	9.10	199	33.17	118.	79.	12.	111.0
1.02	9.20	200	33.33	118.	84.	12.	111.1
1.02	9.30	201	33.50	118.	88.	13.	111.1
1.02	9.40	202	33.67	119.	92.	13.	111.2
1.02	9.50	203	33.83	119.	95.	14.	111.2
1.02	10.00	204	34.00	119.	98.	14.	111.2
1.02	10.10	205	34.17	119.	101.	14.	111.2
1.02	10.20	206	34.33	119.	103.	14.	111.3
1.02	10.30	207	34.50	119.	105.	15.	111.3
1.02	10.40	208	34.67	119.	107.	15.	111.3
1.02	10.50	209	34.83	119.	108.	15.	111.3
1.02	11.00	210	35.00	119.	110.	15.	111.3
1.02	11.10	211	35.17	119.	111.	15.	111.3
1.02	11.20	212	35.33	119.	112.	15.	111.3
1.02	11.30	213	35.50	119.	113.	15.	111.3
1.02	11.40	214	35.67	119.	114.	15.	111.4
1.02	11.50	215	35.83	119.	114.	16.	111.4
1.02	12.00	216	36.00	119.	115.	16.	111.4
1.02	12.10	217	36.17	132.	116.	16.	111.4
1.02	12.20	218	36.33	170.	120.	16.	111.4
1.02	12.30	219	36.50	251.	132.	17.	111.5
1.02	12.40	220	36.67	375.	154.	20.	111.7
1.02	12.50	221	36.83	522.	190.	24.	112.0
1.02	13.00	222	37.00	670.	235.	29.	112.5
1.02	13.10	223	37.17	807.	307.	35.	112.9
1.02	13.20	224	37.33	928.	475.	42.	113.4
1.02	13.30	225	37.50	1030.	674.	47.	113.9
1.02	13.40	226	37.67	1119.	852.	52.	114.2
1.02	13.50	227	37.83	1199.	997.	55.	114.4
1.02	14.00	228	38.00	1268.	1108.	57.	114.6
1.02	14.10	229	38.17	1330.	1198.	59.	114.7
1.02	14.20	230	38.33	1390.	1274.	61.	114.8
1.02	14.30	231	38.50	1453.	1343.	63.	114.9
1.02	14.40	232	38.67	1522.	1414.	64.	115.0
1.02	14.50	233	38.83	1593.	1487.	66.	115.1
1.02	15.00	234	39.00	1660.	1558.	67.	115.2
1.02	15.10	235	39.17	1717.	1624.	68.	115.3
1.02	15.20	236	39.33	1773.	1686.	70.	115.4

1.02	15.40	238	39.67	2136.	1879.	74.	115.6
1.02	15.50	239	39.83	2616.	2150.	79.	115.9
1.02	16.00	240	40.00	3277.	2942.	84.	116.3
1.02	16.10	241	40.17	3908.	3614.	88.	116.5
1.02	16.20	242	40.33	4233.	4085.	91.	116.7
1.02	16.30	243	40.50	4236.	4239.	92.	116.7
1.02	16.40	244	40.67	3992.	4110.	92.	116.7
1.02	16.50	245	40.83	3617.	3794.	90.	116.6
1.02	17.00	246	41.00	3165.	3377.	87.	116.4
1.02	17.10	247	41.17	2791.	2965.	84.	116.3
1.02	17.20	248	41.33	2515.	2642.	82.	116.1
1.02	17.30	249	41.50	2300.	2400.	81.	116.1
1.02	17.40	250	41.67	2111.	2210.	79.	116.0
1.02	17.50	251	41.83	1949.	2081.	78.	115.9
1.02	18.00	252	42.00	1814.	1980.	76.	115.8
1.02	18.10	253	42.17	1689.	1864.	73.	115.6
1.02	18.20	254	42.33	1556.	1741.	71.	115.5
1.02	18.30	255	42.50	1395.	1606.	68.	115.3
1.02	18.40	256	42.67	1198.	1449.	65.	115.1
1.02	18.50	257	42.83	986.	1276.	61.	114.8
1.02	19.00	258	43.00	780.	1091.	57.	114.5
1.02	19.10	259	43.17	600.	903.	53.	114.3
1.02	19.20	260	43.33	450.	727.	49.	114.0
1.02	19.30	261	43.50	340.	591.	45.	113.7
1.02	19.40	262	43.67	258.	478.	42.	113.4
1.02	19.50	263	43.83	197.	399.	39.	113.2
1.02	20.00	264	44.00	149.	328.	36.	113.0
1.02	20.10	265	44.17	114.	289.	34.	112.8
1.02	20.20	266	44.33	89.	258.	32.	112.7
1.02	20.30	267	44.50	71.	238.	29.	112.5
1.02	20.40	268	44.67	57.	219.	27.	112.3
1.02	20.50	269	44.83	47.	201.	25.	112.1
1.02	21.00	270	45.00	40.	184.	23.	112.0
1.02	21.10	271	45.17	34.	165.	21.	111.8
1.02	21.20	272	45.33	30.	149.	19.	111.7
1.02	21.30	273	45.50	27.	134.	18.	111.5
1.02	21.40	274	45.67	25.	120.	16.	111.4
1.02	21.50	275	45.83	23.	108.	15.	111.3
1.02	22.00	276	46.00	22.	98.	14.	111.2
1.02	22.10	277	46.17	21.	88.	13.	111.1
1.02	22.20	278	46.33	20.	80.	12.	111.0
1.02	22.30	279	46.50	20.	73.	11.	111.0
1.02	22.40	280	46.67	20.	68.	11.	110.9
1.02	22.50	281	46.83	20.	64.	10.	110.9
1.02	23.00	282	47.00	20.	60.	9.	110.8
1.02	23.10	283	47.17	20.	57.	9.	110.8
1.02	23.20	284	47.33	20.	54.	8.	110.7
1.02	23.30	285	47.50	20.	51.	8.	110.7
1.02	23.40	286	47.67	20.	48.	7.	110.6
1.02	23.50	287	47.83	20.	46.	7.	110.6
1.03	0.00	288	48.00	20.	43.	7.	110.6
1.03	.10	289	48.17	20.	41.	6.	110.6
1.03	.20	290	48.33	19.	40.	6.	110.5

PEAK OUTFLOW IS 4239. AT TIME 40.50 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4239.	2001.	563.	283.	82015.
CMS	120.	57.	16.	8.	2322.
INCHES		17.73	19.96	20.18	20.18
MM		450.37	506.96	512.66	512.66
AC-FT		992.	1117.	1130.	1130.
THOUS CU M		1224.	1378.	1393.	1393.

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1

RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	1	4236.	2024.	566.	284.	1.05
		(119.94)(	57.31)(	16.03)(	8.05)(	2.72)
ROUTED TO	2	4239.	2041.	563.	283.	1.05
		(120.03)(	56.67)(	15.95)(	8.01)(	2.72)

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	110.00	110.00	115.90
STORAGE	0.	0.	78.
OUTFLOW	0.	0.	2093.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.00	116.72	.82	92.	4239.	2.00	40.50	0.00

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
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[illegible] VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
*********  *********************
1                          PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                RUNOFF HYDROGRAPH AT          1
                                ROUTE HYDROGRAPH TO           2
                                END OF NETWORK


1*********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  26 FEB 79
 *********************************

 RUN  DATE# 81/05/16.
      TIME# 16.44.10.


                    LAKE ROBERT ROOKE DAM (00262)
                    INFLOW HYDROGRAPHY AND ROUTING
                    N J DAM INSPECTION

                                JOB SPECIFICATION
          NQ      NHR     NMIN     IDAY      IHR     IMIN    METRC     IPLT     IPRT    NSTAN
         290        0       10        0        0        0        0        0        4        0
                                   JOPER      NWT    LROPT    TRACE
                                       5        0        0        0


                          MULTI-PLAN ANALYSES TO BE PERFORMED
                              NPLAN= 1 NRTIO= 5 LRTIO= 1
          RTIOS=     .10     .30     .50     .70     .90


      **********          **********          **********          **********          **********

                                SUB-AREA RUNOFF COMPUTATION

        COMPUTE HYDROGRAPH

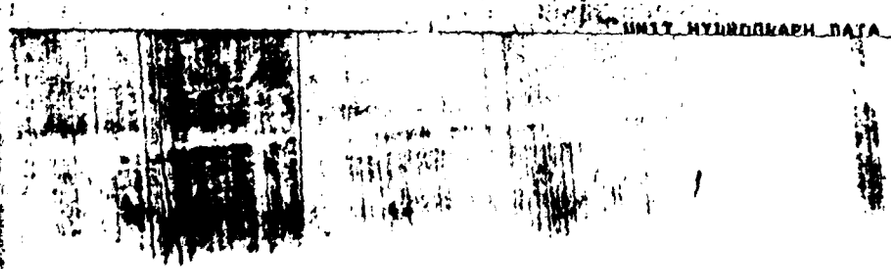
                     ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                         1        0        0        0        0        0        1        0        0

                                    HYDROGRAPH DATA
          IHYDG     IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
              1        2     1.05     0.00     1.05      .80    0.000        0        0        0

                                      PRECIP DATA
                  SPFE      PMS       R6      R12      R24      R48      R72      R96
                  0.00    22.00   112.00   123.00   133.00   142.00     0.00     0.00

                                      LOSS DATA
          LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
              0     0.00     0.00     1.00     0.00     0.00     1.00     1.00      .15     0.00     0.00

                                    UNIT HYDROGRAPH DATA
```



TC= 0.00 LAG= .85

RECESSION DATA
STRTQ= -2.00 QRCSN= 0.00 RTIOR= 1.00

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
						END-OF-PERIOD FLOW							
									SUM	24.99	20.16	4.83	82450.
										(635.)(	512.)(	123.)(	2334.72)

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HYDROGRAPH ROUTING

ROUTING COMPUTATIONS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	-1

STAGE	110.00	111.00	112.70	113.00	113.50	114.00	115.00	115.90	116.00
FLOW	0.00	75.00	262.00	318.00	496.00	742.00	1380.00	2093.00	2231.00
CAPACITY=	0.	12.	23.	36.	49.	64.	80.	98.	114.
ELEVATION=	110.	111.	112.	113.	114.	115.	116.	117.	118.

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
110.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
115.9	0.0	0.0	0.

PEAK OUTFLOW IS 287. AT TIME 41.17 HOURS

PEAK OUTFLOW IS 1189. AT TIME 40.67 HOURS

PEAK OUTFLOW IS 2005. AT TIME 40.67 HOURS

PEAK OUTFLOW IS 2968. AT TIME 40.50 HOURS

PEAK OUTFLOW IS 3815. AT TIME 40.50 HOURS

FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .30	RATIO 3 .50	RATIO 4 .70	RATIO 5 .90
HYDROGRAPH AT	1	1.05	1	424.	1271.	2118.	2965.	3812.
		(2.72)	(	11.99)(	35.98)(	59.97)(	83.96)(	107.95)(
ROUTED TO	2	1.05	1	287.	1189.	2005.	2968.	3815.
		(2.72)	(	8.14)(	33.66)(	56.78)(	84.03)(	108.03)(

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	110.00	110.00	115.90
STORAGE	0.	0.	78.
OUTFLOW	0.	0.	2093.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	112.84	0.00	34.	287.	0.00	41.17	0.00
.30	114.70	0.00	59.	1189.	0.00	40.67	0.00
.50	115.79	0.00	76.	2005.	0.00	40.67	0.00
.70	116.26	.36	84.	2968.	1.17	40.50	0.00
.90	116.57	.67	90.	3815.	1.67	40.50	0.00

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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
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APPENDIX 5

REFERENCES

APPENDIX 5

REFERENCES

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